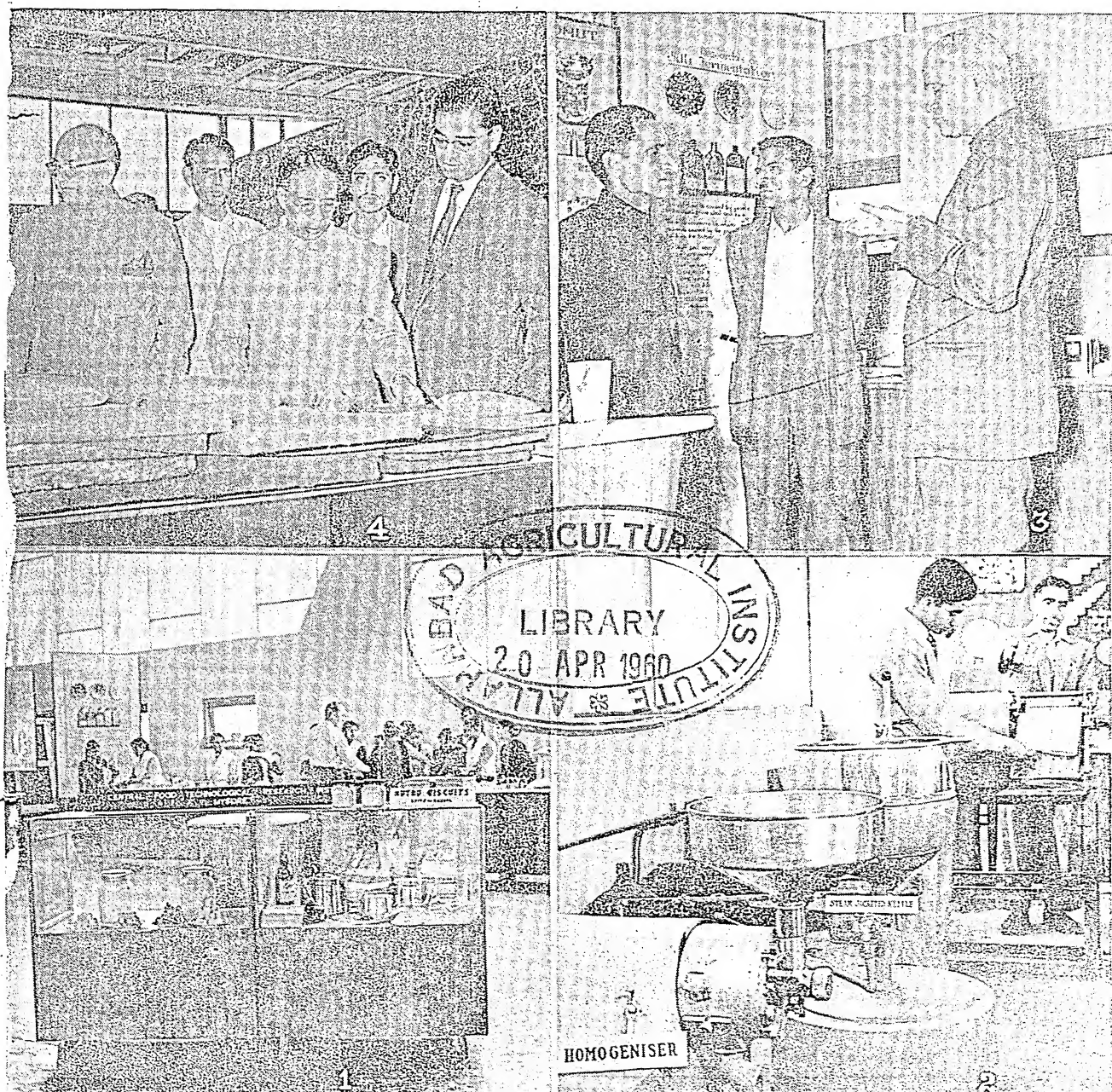


FOOD SCIENCE

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE, MYSORE



C.F.T.R.I. STALL IN SCIENCE PAVILION OF THE WORLD AGRICULTURE FAIR, NEW DELHI

- 1) A view of the stall with students receiving training in Fruit and Vegetable Preservation. (2) Demonstration of the preparation of Mango Cereal Flakes. (3) Shri P. M. Sundaram, Secretary, CSIR, examining the products standardised by the C.F.T.R.I. (4) Prof. Humayun Kabir, Minister and Prof. M. S. Thacker, Secretary, Ministry of Scientific Research and Cultural Affairs, Government of India, evincing interest in the Institute products.

C.F.T.R.I. PUBLICATIONS

1. SOME ASPECTS OF FOOD TECHNOLOGY IN INDIA (*published in August 1959*), pp. 160.

This is a publication specially brought out on the occasion of the F.A.O. Regional Seminar on Food Technology for Asia and the Far East held in Mysore from August 1-8, 1959. It is a collection of 26 review articles, which cover exhaustively the research work done in India on some of the important aspects of Food Science and Technology, particularly those dealing with rice and rice substitutes; fruit and vegetable products; dehydration of foods; storage, packaging and transport of perishables; infant, invalid and protein-rich foods; beverages, spices and condiments; etc. The book represents under one cover the important lines of work and progress made in India in the field of Food Technology.

Price: (Bound) Rs. 10.00 (*postage extra*); £.£.5.0; \$ 4.00.
(Ordinary) Rs. 5.00 (,,); £.0.12.0; \$ 2.00.

2. FRUIT AND VEGETABLE PRESERVATION INDUSTRY IN INDIA (*published in May 1956*) pp. xiv + 485. (Compiled and edited by R. C. BHUTANI).

This publication is packed with up-to-date technical and statistical data on several aspects of the Fruit and Vegetable Preservation Industry spread over 65 papers read and presented by scientists, technologists, industrialists (manufacturers of food products, machinery, additives, containers and packaging) as well as importers and exporters. Some papers also bring out adequately the various stages of development of the Industry in the country and the handicaps with which it is faced today. The inclusion of the discussions which followed each of the papers read, has added to the usefulness of the book. It also contains the Recommendations of the Symposium submitted to the Planning Commission for consideration in respect of schemes to be included in the Second Five-Year Plan.

Price: Indian, Rs. 6.00 (*postage extra*); Foreign, 15 shillings; \$ 2.50

3. TECHNICAL AID TO FOOD INDUSTRIES (*published in July 1954*), pp. xvi + 270.

This publication, contains the views and suggestions of prominent scientists, leading industrialists and food technologists, and Government officials on the nature of technical aid needed by different food industries in the country. Up-to-date technical and statistical data are provided and an appendix embodying the conclusions of the Symposium as well as a comprehensive index are given.

Price: Indian, Rs. 5.00 (*postage extra*); Foreign, 10 shillings; \$ 1.75

4. FOOD AND POPULATION AND DEVELOPMENT OF FOOD INDUSTRIES IN INDIA (*published in July 1952*) pp. xv + 357.

This book brings together the views and suggestions of leading thinkers, industrialists, scientists, demographers and other experts on the two topics. Packed with up-to-date technical and statistical data on several food industries such as fruit preservation, biscuit, chocolate, confectionery, glucose, flour-milling, food yeast, vanaspati, edible oils, fish processing, food machinery and the refrigerated preservation of perishable foods, this authoritative document brings into relief the handicaps and potentialities of these Industries in India. An appendix embodying the recommendations of a Committee of Experts, and a comprehensive index enhance the usefulness of the book.

Price: Indian, Rs. 5.50 (*postage extra*); Foreign, 10 shillings; \$ 1.75

the protein content of the final product to about 22-24 per cent and fat to about 14-16 per cent (6) fortification with vitamins (7) homogenisation (8) drying (9) powdering and (10) packing.

A brief account of the various steps involved in the process is given in this paper and the flow sheet shown in Figure 1.

Collection of milk: The buffalo milk used in the large scale production was supplied by a co-operative dairy. The milk was received at the dairy from the neighbouring areas (within a radius of about 20 miles) within 2-3 hours of milking. Immediately on arrival the milk was examined for its fat content, solids-not-fat (by lactometer), methylene blue reduction time and standard plate count. The milk was pasteurized at the dairy before being sent to the factory. The pasteurization temperature was maintained at 185°F with an idea of developing sulphhydryl groups in the milk at this stage.⁴ The characteristics of the buffalo milk for the preparation of infant food are given in Table I.

TABLE I. *Some quality characteristics of fresh buffalo milk*

Fat	6.5 %
S.N.F.....	9.0 %
Total count.....	4.1×10^5
M.B.R. time.....	greater than 6 hours.

Fat adjustment: The average fat content of the milk received was 6.5 per cent. For the preparation of infant food, the fat was adjusted to 2.5 per cent. This was done by passing the pasteurized milk through cream separators adjusted to give a fat content of 2 per cent in the separated milk. The final fat content of the milk was adjusted to 2.5 per cent by adding pasteurized cream.

Adjustment of composition: The milk after standardization was transferred into a stainless steel milk holding tank provided with a revolving heating coil which maintained the temperature of milk at 60°C. The water soluble vitamins, thiamine, riboflavin, niacinamide and pyridoxine were dissolved in water and added to the milk. The fat soluble vitamins, A D and E were made into a premix with hydrogenated fat and redissolved in cream before addition to the milk. Calculated

quantities of disodium phosphate and sodium citrate in solution were also added. Cane sugar was then added in the proportion of one part of sugar to three parts of total milk solids. The cane sugar added was first dissolved in water and the syrup boiled for five minutes to avoid contamination of the pasteurised milk with any microorganism present in sugar.

Homogenisation, preheating and drying: The milk was homogenised under a pressure of 1000 lb. per sq. in. It was preheated to 60°C and fed on to the roller driers. The roller drier (Manufactured by James Bell Machinery Pty. Ltd., Melbourne) used for drying the milk consisted of two rollers of length 5 feet and diameter 2 feet revolving at a speed of 16 revolutions per minute. The rollers were internally heated with steam at a pressure of 50 pounds per sq. in. With uniform feeding, the drying of milk was very satisfactory. The dried milk came off the rollers in thin sheets which were collected in trays on either side of the rollers.

Powdering and packing: The dried milk was then powdered in a disintegrator. The powdered infant food was packed in air in 1 lb. tins provided with tagger tops and lever lids.

Composition of the roller dried infant food: Table II shows the composition of the product. The solubility of the infant food determined according to the method outlined by Howat *et al.*⁵ was 84.9 per cent. The curd tension of the reconstituted milk as determined by the method of Chandrasekhara *et al.*⁶ was 3.5.

TABLE II. *Chemical composition of roller dried infant food*

Constituent	%	Vitamins added per 100g. powder	
Moisture	2.4	Vitamin A (I.U.) ...	3000
Protein	23.2	„ D (I.U.) ...	400
		„ E (mg) ...	2
Carbohydrates (lactose and cane sugar) ...	55.7	Thiamine (mg) ...	1
Fat	14.0	Riboflavin (mg) ...	1
Ash	4.7	Niacinamide (mg) ...	6
Calcium	1.1	Pyridoxine (mg) ...	0.6
Phosphorus	1.1	Vitamin B ₁₂ (mg) ...	2
		„ C (mg) ...	30

Acknowledgement

We are very grateful to the Managers of M/s Healthways Ltd., Varanasi for all the help rendered by them in the large scale manufacture of roller dried infant food in their factory.

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INFANT FOOD FROM BUFFALO MILK**VII. Shelf-life of roller dried infant food**

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The initial quality of the milk and the conditions of manufacture, packaging and storage, mainly control the shelf-life of dried milk foods^{1,2}. Available evidence show that roller dried milk foods prepared from cow's milk have in general a better keeping quality than spray dried foods³. Spray dried milk foods have to be invariably packed under an inert atmosphere like nitrogen or carbon dioxide to prolong the shelf-life, while roller dried milk foods even when packed in air have a fairly good shelf-life³. In a previous paper Chandrasekhara *et al.*⁴ reported that spray dried infant food prepared from buffalo milk when packed in nitrogen (oxygen in head space 7 per cent) and stored at 37°C had a shelf-life of 8 months. No information is available in the literature on the keeping quality of roller dried infant food prepared from buffalo milk. The results of such a study are reported in this paper.

Experimental

The method of preparation and the composition of the different samples of infant food used in these studies have been described in a previous communication⁵. Two lots of roller dried infant food (with and without added iron) were prepared from the same batch of milk. Both the samples were prepared under identical conditions. For fortifying with iron, the required amount of ferric citrate was added to the milk so that the dried food contained 6 mg. per 100 g. extra iron over

the control. The chemical composition of both the lots of roller dried infant food was the same; they contained on the average 14 per cent of fat and 22 per cent of protein. The iron content of the two samples were 12.5 and 19.3 mg. per 100 g. The high iron content of the control sample may be due to contamination from the iron rollers.

Method of packing and condition of storage: Samples of the roller dried infant food soon after preparation were packed in seamed unlacquered tin cans (8 oz. size) in air with minimum head space. The cans were stored both at room temperature (25°-29°C) and at 37°C. Three cans from each treatment were removed at intervals for examination.

Chemical analysis of infant foods: The moisture content of the infant food was determined by drying the powder to constant weight at 100°C in an air oven. The solubility of the infant food was determined according to the method of Howat *et al.*⁶ and it was always corrected for the moisture content of the powder. Fat acidity was determined by the method of Chandrasekhara *et al.*⁵.

The thio-barbituric acid value of the infant foods which is an index of rancidity, was estimated by the method of Sidwell *et al.*⁷. Thiamine in infant foods was determined by the method of Swaminathan⁸.

Organoleptic evaluation: The organoleptic quality of the infant foods was determined accor-

ding to the method of Lea *et al.*³. A scoring system similar to that used by Lea *et al.*³ was followed. The different grades were as follows: 0=as good as freshly made powder; 1=suspicion of off-flavour; 2=slight off-flavour but palatable; 3=marked off-flavour and unpalatable and 4=very marked off-flavour (highly unpalatable).

For the preparation of reconstituted milk, thirteen grams of infant food were dissolved in 100 ml. of water at 60°C. and kept warm on a water bath. The infant food having a score higher than 2 was considered unsuitable for infant feeding.

Results and Discussion

Organoleptic evaluation: The rates of development of off-flavour in different samples of infant food are shown in Figure 1. As stated earlier the time taken for the infant food to attain a score of 2 was considered to represent the maximum shelf-life of the product. It should, however, be mentioned that there is no proportionality between the numerical organoleptic scores and degree of off-flavour. For example

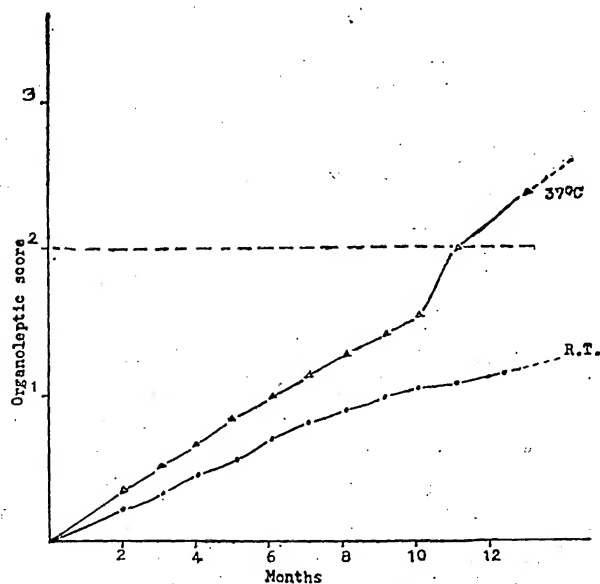


FIG. 1. Organoleptic evaluation of off-flavour developed in infant foods* during storage.

* The organoleptic score of the samples of roller dried infant food with and without added iron at different periods of storage are almost the same.

an infant food with an organoleptic score of 3 will have an off-flavour many times that of a sample having a score of 2. The results show that the roller dried infant food (with or without added iron) has a shelf-life of 10 months at 37°C. Assuming a temperature co-efficient of 2 for every 10°C rise in temperature, we may conclude that the infant food can keep at room temperature (25°-29°C) for a period of 20 months. Chandrasekhara *et al.*⁴ reported that a spray dried infant food having a composition similar to that of the roller dried infant food used in the present studies, when packed in air, had a shelf-life of 4.2 months at 37°C. The results obtained in the present study are in accordance with those of Lea *et al.*³ who reported that roller dried milk food from cow's milk had a longer shelf-life than spray dried milk food, when both were packed and stored under similar conditions.

Thio-barbituric acid value: It has been observed by a large number of workers that the peroxide value of the fat in a food may not be a good index of the organoleptic quality of the food. It has also been observed that during storage, the peroxide value increases gradually and after a time decreases. This may be due to the breaking down of peroxides at a faster rate than their formation. Sidwill *et al.*⁷ observed that the thio-barbituric acid value of a milk food steadily increased during storage and was a better index than peroxide value of the organoleptic quality of the product. It may be mentioned that the thio-barbituric acid value is a measure of the ketones and aldehydes which are the breakdown products of peroxides. The thio-barbituric acid values of the different samples of infant food are given in Table I. Comparing this data with the results of organoleptic studies, it will be observed that the infant food becomes unacceptable when its T.B.A. value is more than 0.13.

Fat acidity: It is very likely that the bacteria present in milk may produce lipolytic enzymes in addition to the lipase already present in milk⁹. During heating and drying of milk the enzymes may not be completely destroyed. The fat acidity in different samples was determined periodically and the results are shown in Table II. The data indicate that a slight increase in the fat acidity occurs in all the samples during storage.

TABLE I. *T.B.A. value of different samples of infant foods during storage*

Period of storage (months)	Roller dried infant food (A)		Roller dried infant food (B)	
	R.T.	37°C	R.T.	37°C
0	0.005	0.005	0.009	0.009
2	0.016	0.034	0.014	0.030
4	0.032	0.066	0.030	0.062
6	0.040	0.082	0.040	0.078
8	0.052	0.110	0.052	0.110
10	0.062	0.138	0.058	0.126
12	0.072	0.150*	0.069	0.146*

* Organoleptically rancid

A—Fortified with iron B—Without added iron

TABLE II. *Fat acidity* of different samples of infant foods during storage*

Period of storage (months)	Roller dried infant food (A)		Roller dried infant food (B)	
	R.T.	37°C	R.T.	37°C
0	0.80	0.80	0.80	0.80
2	0.94	1.12	0.85	0.95
4	1.20	1.32	0.92	1.12
6	1.30	1.48	1.10	1.30
8	1.35	1.56	1.14	1.34
10	1.38	1.62	1.16	1.36
12	1.42	1.68	1.21	1.40

* Acidity expressed as mg. of KOH per g. of infant food.

A—Fortified with iron B—Without added iron

Stability of thiamine: The effect of storage of milk powder on the loss of vitamins has been studied by a large number of workers. Thompson and Kon⁹ studied the stability of vitamins in spray dried milk powder (packed in air and inert gas) during storage for one year at room temperature. Thiamine and riboflavin contents showed no change after 12 months storage. The thiamine content of the different samples of roller dried infant food was estimated after a period of 6 and 12 months of storage both at room temperature and 37°C. The results are given in Table III. The results show that thiamine in infant food was lost to the extent of 15 per cent at room temperature and 25 per cent at 37°C during storage for a period of one year.

TABLE III. *Loss of thiamine in infant food during storage*

Sample	Period of storage	Thiamine content of infant food ($\mu\text{g/g}$)	
		R.T.	37°C
Roller dried infant food (A)	0	8.0	8.0
	6	7.5	7.2
	12	6.8	6.2
Roller dried infant food (B)	0	8.2	8.2
	6	7.6	7.4
	12	6.6	6.1

A—Fortified with iron B—Without added iron

Summary

1. The keeping quality of roller dried infant food prepared from buffalo milk and packed in air has been studied. The infant food prepared from milk collected under conditions prevailing in the dairy had a shelf-life of 10 months at 37°C and an expected shelf-life of 20 months at room temperature (25°-29°C).

2. The thio-barbituric acid value of the infant foods increased steadily during storage. Fair agreement was observed between the thio-barbituric acid value and the organoleptic acceptability of the stored food.

3. Thiamine present in the food was lost to the extent of 15 per cent and 25 per cent respectively when stored at room temperature and 37°C for a period of one year.

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INFANT FOOD FROM BUFFALO MILK

VIII. Infant feeding trials with roller dried food

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In earlier communications¹⁻² from this laboratory, investigations relating to the large scale production and shelf-life of roller dried infant food from buffalo milk have been reported. The results have shown that roller dried infant food prepared from buffalo milk has a good solubility and a low curd tension. The food packed in tins in air had a shelf-life of about 10 months at 37°C. The present paper gives the results of feeding trials on infants with roller dried milk food from buffalo milk.

Experimental

Material: The roller dried infant food used for the feeding trials was the same as that described in an earlier paper¹. Data regarding the composition of the product has already been reported.

Feeding of infants: The feeding trials were carried out on 17 infants. The infants belonged to the middle and lower middle classes. The infants were first clinically examined and were found to be in good health and free from ailments which may interfere in the experiments. The age was recorded to the nearest month. The period of feeding varied from 1 month to 3½ months. Fortnightly records of the weights of infants were maintained. Records regarding the digestibility of the infant food and the clinical condition of the infants were maintained throughout the experimental period. The results are presented in Table I and Fig. 1.

Results and Discussion

The clinical data (Table I) obtained show that all the infants under experiment digested the food readily. The infants also consumed with great relish the reconstituted milk and there were no cases of vomiting after the intake of the food. The results presented in Table I show that the average rate of growth of infants per month was 0.89 lb. It will be observed that infants whose weights were much below normal at the start of the experiment grew at a lower rate than those whose

TABLE I. Feeding trials with roller dried infant food

Sl. No.	Sex	Age at start (months)	Duration of feeding (months)	Weight at the beginning of the experiments (lb)	Weight at the end of feeding period (lb)	Increase in weight (lb)	Increase in weight per month (lb)*
1	M	10	3.5	17.88	20.13	2.25	0.64
2	M	3	3.5	8.00	10.63	2.63	0.75
3	M	10	3.5	16.31	18.75	2.44	0.70
4	M	8	3.5	13.38	16.94	3.56	1.02
5	M	9	3.5	15.69	17.75	2.06	0.59
6	F	7	3.5	13.31	16.00	2.69	0.77
7	M	10	3.5	17.25	19.38	2.13	0.61
8	F	5	3.5	9.31	13.50	4.19	1.20
9	M	1	3.5	5.60	10.28	4.68	1.38
10	M	9	3.5	14.47	16.69	2.22	0.63
11	F	9	3.5	13.13	15.25	2.12	0.61
12	M	6	3.5	11.44	14.19	2.75	0.79
13	M	5	3.5	9.88	13.50	3.62	1.03
14	M	8	3.5	12.38	15.44	3.06	0.87
15	M	2	1.0	6.81	7.56	0.75	0.75
16	M	2	1.0	6.38	7.94	1.56	1.56
17	F	2	1.0	7.06	8.38	1.32	1.32

* Average increase in weight per month is 0.89 lbs.

body weights were near normal. Illingworth *et al.*³ reported that the rate of growth of infants during the first year was related to the birth weight.

It was not possible to include a control group of infants on either cow's milk or on a proprietary infant food. This was due to the fact that sufficient number of infants were not available for the experiment. The standard growth curve for comparing the growth rate of infants fed on the roller dried infant food was obtained as follows: The weights of the infants at the beginning of the experiment were plotted against their age. The standard growth curve shown in Fig. 1 was drawn by fitting a smooth curve to the various points arrived at by plotting the average weight of the infants against their age. The average increase in weight per month of infants fed on roller dried infant food as com-

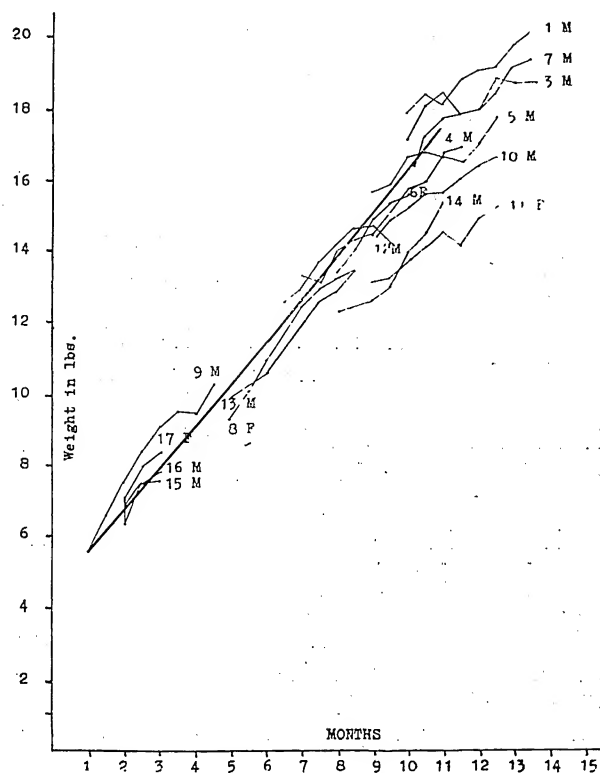


FIG. 1. Growth of infants on roller-dried infant food

pared with that obtained earlier with spray dried infant food is given in Table II. It is interesting to note that the average rate of growth per month of infants obtained in the present investigation

TABLE II. Increase in weight of infants fed on spray and roller dried infant foods

Name of centre	No. of infants	Age of infants (months)	Duration of feeding (months)	Average increase in weight per month (lb)
<i>Roller dried infant food</i>				
Mysore ...	17	1.5—10	1—3.5	0.89
<i>Spray dried infant food</i>				
Mysore ...	52	0.3—11.5	1—5	0.83
Delhi ...	10	0.9—2.5	1—2	1.60
Calcutta ...	22	1—24	0.5—4	2.00

(0.89 lb.) is almost the same as that (0.83 lb.) obtained earlier in the case of infants fed on spray dried infant food prepared from buffalo milk⁴. The rate of growth of infants observed in the present experiment compares favourably with the average growth rate reported in the literature for Indian infants. The present investigation, though carried out on comparatively small number of infants, has nevertheless clearly demonstrated that the roller dried infant food prepared from buffalo milk is readily digestible and promotes good growth in infants.

Summary

1. Feeding experiments with a roller dried infant food prepared from buffalo milk were conducted under strict medical supervision on 17 infants. The infant food contained 22 per cent protein and 14 per cent fat and was fortified with vitamins A and D and all B-complex vitamins. Records regarding the growth and general health of the infants and the digestibility of food were maintained.

2. All the infants digested the infant food readily. The infants consumed the reconstituted milk with relish and no cases of vomiting after the ingestion of milk were reported. The average rate of growth of the infants was quite satisfactory and was almost similar to that observed earlier on infants fed on spray dried infant food.

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ASSESSMENT OF INSECT INFESTATION AND ACCEPTABILITY OF MARKET SAMPLES OF FOOD GRAINS—Part I: Studies on wheat-flour

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Food grains and their products are infested by various species of insects. Insects being uricotelic organisms, uric acid is excreted by them. Subrahmanyam *et al.*¹ have demonstrated that uric acid can serve as an index of insect filth in samples of cereal grains infested under controlled conditions. Venkatrao *et al.*²⁻³ studied the relation between uric acid content and the extent of kernel damage in infested Bengal gram (*Cicer arietinum*) and field bean (*Dolichos lablab*) and reported that uric acid contents of the material increased with the number of exit-holes in the seeds. These investigations indicated the possibility of extending the use of uric acid level in a commercial sample as an index of its unhygienic condition. The extent of insect infestation in whole grains could be assessed from the kernel damage and insect count. It is, however, more difficult to judge the extent of insect infestation in a milled product by visual inspection than in the case of whole grains. During the process of milling, damaged kernels and all body parts of insects are ground finely. So in assessing the extent of insect infestation in a milled product fragment count and uric acid content are probably the only two indices which could be used. Although the method of insect fragment count has been used as an index of unhygienic quality of milled products⁴, the data with reference to the organoleptic quality of the products are lacking. So studies were undertaken to find out the relation of uric acid content and insect-fragment count to the organoleptic quality of the milled products. In the present communication data obtained on the above aspects with market samples of wheat flour are presented.

Experimental

Materials: Sixty samples of whole wheat flour were obtained from shops in and around Mysore city.

Methods of analysis: The flour samples were analysed for (1) insect-fragment count (2) uric

acid content and (3) organoleptic quality by the following procedures.

Insect fragment count: Insect fragment count was obtained according to the procedure of Harris *et al.*⁴.

Uric acid: The method for the estimation of uric acid contents of the samples was the same as described by Venkatrao *et al.*⁵. Essentially the method consists of the following steps: (1) extraction of uric acid from the flour with water, (2) determination of the total uric acid content in the protein-free aqueous extracts using the Benedict's uric acid reagent, (3) destruction of uric acid in aliquots of the extract by the enzyme uricase and estimating the apparent uric acid-like substances reacting with the uric acid reagent, and (4) determination of the true uric acid content of the extract as the difference between the 'total' and 'apparent' uric acid values.

Organoleptic quality: Random samples of the flour were used for assessing the organoleptic quality of the dough and *chapati* (unleavened bread) prepared from the flour as follows:

Preparation of dough: The dough was prepared by adding the required amount of cold water (water: flour, 1:4, by volume) and salt to the flour, mixing and kneading with the hand.

Preparation of chapati (unleavened bread): About 25 g. of the dough was rolled to a size of 4¹¹ diameter. This was baked on both sides for a few minutes on a hot plate till the *chapati* puffed and attained a light brown colour.

The different samples were organoleptically evaluated by a panel of 6 judges. The judges examined the products for texture, smell, taste and acceptability and evaluated using a maximum score of 10. The ranges of organoleptic score and the acceptability were as follows: 10-7 highly acceptable; 6.9-4 acceptable; 3.9-2 bad, not acceptable and 2.9-0 very bad.

Results and Discussion

The insect fragment counts, uric acid contents and the results of studies on the organoleptic

evaluation of wheat flour samples are presented in Table I. The distribution of the samples with reference to the different ranges of insect fragment count, uric acid and organoleptic quality of *chapati*, and dough are given in Tables II, III and IV respectively.

Insect fragment count: The insect fragment count of the different market samples ranged from 0-825 per 100 g. of material. It may be seen from Table I that the insect fragment count although in general, indicates the degree of infestation, cannot serve as a very reliable index of organoleptic quality of the material. In the case of some acceptable samples of wheat flour, the fragment counts were very high, while low fragment counts were obtained in samples of low organoleptic qualities. The former case might have arisen due to the influx of fresh insect population from other infested stocks stored adjacent to the sampled stock and the latter was due to sieving and other cleaning operations either prior to milling or before the sale of the wheat flour by the merchant.

Uric acid content: The uric acid content of the different samples ranged from 0-160 mg. per 100 g. of material. Uric acid content of the different flour samples indicate (Table I) the degree of acceptability of the samples more uniformly, than the insect fragment count. Both the dough and *chapatis* prepared out of most of the wheat flour samples having less than 15 mg. of uric acid per 100 g. of material were acceptable. It may be seen from Table III that 73 per cent of the market samples analysed, have less than 15 mg. of uric acid per 100 g. of material.

The uric acid contents of flour samples result from the activities of insects in the whole grain prior to milling and in the milled product during storage. The whole wheat grain is usually infested by *Sitophilus oryza* and occasionally by *Trogoderma* sp. and *Rhizopertha* sp., while flour gets infested mostly by *Tribolium castaneum* and *Ephestia* sp. The whole grain when infested can be detected by the presence of damaged kernels, but flour samples do not reveal any indication of infestation on visual inspection.

Since uric acid is the major constituent of insect excreta, it is reasonable to assume that the

TABLE I. *Uric acid, insect fragment count and organoleptic evaluation of market samples of wheat flour*

Sample No.	Insect fragments (per 100g)	Uric acid (mg./100g)	Organoleptic score of	
			Dough	Chapati
1	1	1.9	8.0	8.0
2	104	5.6	...	...
3	22	1.9	...	...
4	60	3.2	7.0	7.0
5	78	5.5	4.8	4.1
6	60	6.5	...	...
7	3	1.8	...	...
8	103	7.0	4.0	4.5
9	22	26.5	2.0	2.0
10	20	2.1	...	...
11	434	31.4	4.0	4.0
12	326	8.0	3.5	4.9
13	301	34.8	5.0	6.3
14	81	0.98	6.5	6.5
15	81	0.70	...	...
16	648	54.7	1.0	1.0
17	302	5.1	4.4	4.2
18	106	1.8	6.5	6.5
19	815	26.8	...	...
20	81	...	...	...
21	80	...	6.0	6.0
22	168	...	7.0	7.0
23	120	32.0	...	...
24	60	...	...	...
25	60	...	...	...
26	110	32.6	...	...
27	625	39.7	...	...
28	60	0.2	6.2	6.2
29	649	32.0	...	...
30	80	0.7	...	...
31	453	158.1	1.0	1.0
32	482	130.3	...	...
33	26	...	6.4	7.1
34	255	48.0	2.0	2.0
35	40	...	4.9	5.6
36	460	50.7	5.0	5.7
37	475	58.2	...	...
38	580	104.5	1.5	1.5
39	125	7.0	5.5	5.0
40	32	...	...	...
41	26	9.7	2.8	2.2
42	159	10.5	4.8	5.5
43	230	7.8	5.0	5.0
44	360	8.4	5.5	5.5
45	573	2.0	...	...
46	307	9.8	2.8	3.8
47	nil	0.5	4.0	4.6
48	41	0.2	...	...
49	nil	0.9	...	...
50	21	2.5	...	...
51	247	14.6	2.8	2.9
52	113	10.2	5.1	6.5
53	750	115.0	2.1	1.1
54	129	2.5	6.0	7.0
55	100	0.0	5.6	6.4
56	59	12.0	...	...
57	8	...	...	...
58	38	5.0	...	...
59	51	5.4	...	...
60	213	13.6	6.0	6.3

TABLE II. *Distribution of samples with reference to insect fragment count*

Insect fragment count (range)	Sample number	Number of samples	% of total samples
0-50	47, 49, 1, 3, 7, 9, 10, 33, 50, 57, 35, 40, 41, 48, 58,	15	25
51-100	4, 6, 24, 25, 28, 56, 59, 5, 14, 15, 20, 21, 30, 55,	14	23.3
101-200	2, 8, 18, 23, 26, 39, 52, 54, 22, 42	10	16.7
201-300	60, 43, 51, 34	4	6.7
301-400	13, 17, 46, 12, 44	5	8.3
401-500	11, 31, 36, 37, 29, 32	6	10.0
501-600	38, 45	2	3.3
601-825	27, 16, 53, 19	4	6.7

TABLE III. *Distribution of samples with reference to uric acid*

Uric acid	Sample number	No. of samples	% of total samples
0-5	1, 3, 4, 7, 10, 14, 15, 18, 20, 21, 22, 24, 25, 28, 30, 33, 35, 40, 45, 47, 48, 49, 30, 54, 55, 57, 58	27	45.5
5.1-10	2, 5, 6, 8, 12, 17, 39, 41, 43, 44, 46, 59	12	20.0
10.1-15	42, 51, 52, 56, 60	5	8.3
15.1-30	9, 19	2	3.3
30.1-50	11, 13, 23, 26, 27, 29, 34	7	11.7
50.1-100	16, 36, 37	3	5.0
100.1-160	38, 53, 32, 31	4	6.7

quantities of the substances contributing to the off-flavour and bitterness of an insect infested product will be proportional to the uric acid content. This fact is borne out by findings of organoleptic tests carried out in this investigation. There is no information available on the production of different substances responsible for the off-odour and bitter taste by these insect pests of the whole grain and flour. Studies on these substances are in progress.

TABLE IV. *Distribution of samples with reference to organoleptic quality*

Organoleptic score of (range)	Sample number	Number of samples	% of total samples
<i>Chapatis</i>			
10-7	1, 4, 22, 33, 54	5	14.7
6.9-4	5, 8, 11, 12, 13, 14, 17, 18, 21, 28, 35, 36, 39, 42, 43, 44, 47, 52, 55, 60	20	58.8
3.9-2	9, 34, 41, 46, 51	5	14.7
1.9-0	16, 31, 38, 53	4	11.8
<i>Dough</i>			
10-7	1, 4, 22	3	8.8
6.9-4	5, 8, 11, 13, 14, 17, 18, 21, 28, 33, 35, 36, 39, 42, 43, 44, 47, 52, 54, 55, 60	21	61.7
3.9-2	9, 12, 34, 41, 46, 51, 53	7	20.6
1.9-0	16, 31, 38	3	8.8

Summary

Market samples of whole wheat flour were analysed for insect fragment count and uric acid content to assess the extent of insect infestation. Organoleptic quality of dough and *chapati*, prepared with the samples was also studied.

Uric acid contents were found to indicate the degree of acceptability of the samples more uniformly than the insect fragment counts. On the basis of organoleptic quality, samples containing upto 15 mg. of uric acid per 100 g. of material, were acceptable and 73 per cent of the samples analysed were within this limit.

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THE PRESENT POSITION OF GLASS CONTAINERS FOR THE FRUIT AND VEGETABLE PRESERVATION INDUSTRY IN INDIA

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Although canned products occupy a prominent position among preserved fruits and vegetables, other products like juices, squashes and cordials, jams, jellies and marmalades, ketchups and sauces, candied and crystallised fruits, etc., also are equally important. For packing several of these products, glass containers are either essential or are to be preferred on account of the visibility of the contents in them and the consequent eye-appeal and sales potential, especially in a country like ours, where the appearance of a food product is perhaps the most decisive factor from the point of view of the customer. Although the earliest 'canning' was in glass containers, the development of the open-top tin can, almost to perfection, as regards its suitability for use on high speed automatic processing machines, nearly ousted the glass containers for canning fruits and vegetables. There is, however, still a demand for glass jars of special type like Kelner and Sutax jars with metal caps, which can be used by the housewife for canning fruits and vegetables at home during the season. Such jars are not easily available in India, and this is likely to be a 'set-back' to the proposed popularisation of home preservation of fruits and vegetables in the coming years during the Second Plan period. People have to be taught to become increasingly aware of the usefulness and advantage of these preserved products and thereby indirectly help in the rapid development of the large scale preservation industry in the country. When these preserved products become popular, the chances of reducing the present high costs of the products as well as of the containers will be brighter indeed.

Type of Containers required by the Preservation Industry

The ideal container for canned foods should be strong enough to protect its contents adequately, impervious to air and water, not harmful or toxic to the contents and be capable of being

readily hermetically sealed and sterilized. Further, it should be light for economical handling, readily fabricated in attractive shapes and sizes and fairly inexpensive. These qualities are satisfied by tin or glass containers. In the case of the glass containers, however, in spite of the great advantage of the visibility of the products packed inside, their comparatively greater weight, less resistance to thermal and mechanical shock and higher requirement of man-power for handling, are the chief disadvantages when compared with the all-purpose tin-container. In recent years, however, glasses having less of these disadvantages have been developed, but their adoption on a large scale in the place of the cans makes the preserved products highly expensive. The glass container can only be an alternative container, but not a substitute one, for cans so far as canning of heat-processed foods is concerned. There are, however, other products where the glass container cannot be replaced by the tin can. For instance, in the case of products like fruit squashes and cordials, which are highly acidic and are chemically preserved, and ketchups, sauces, pickles and chutneys, which are not only acidic, but also contain a considerable amount of salt, glass containers are essential. The main types of glass containers required by the fruit and vegetable preservation industry may be broadly classified as follows:

1. Bottles for packing fruit juices, squashes, cordials and syrups.
2. Bottles and jars for jams, jellies and marmalades.
3. Bottles and jars for pickles, sauces, chutneys, relishes and vinegars, etc.

In addition to these, as already mentioned, special types of glass jars and bottles, which can be substituted for cans, are also required, to popularise home canning. These containers, however, are not essential to the canning industry.

Desirable Physical and Chemical characteristics of Glass Containers

The different types of glass containers required for packing different types of products should satisfy certain essential conditions. In the case of glass containers used for canning heat-processed foods, conditions regarding hermetic sealing and resistance to thermal shock during sterilization and cooling should be perfect. Similar conditions hold good in the case of heat-processed fruit and vegetables juices, vinegar, ketchup and sauces also. In the case of bottles used for packing fruit squashes, cordials and syrups, however, resistance to thermal shock is not so important as that to mechanical shock, as these products are generally preserved in the cold by the addition of chemical preservatives like sulphur dioxide and sodium benzoate. Resistance to thermal shock is, however, still desirable to facilitate the cleaning and sterilization of the empty bottles.

Effect of the Composition of Glass on the Quality of the Products

The glass of the container should not have any deleterious effect on the colour and taste and flavour of the product packed in it. This aspect of the problem, however, requires a critical investigation. The composition of the glass as regards its iron content and the form in which it exists, whether as ferrous or ferric, and the alkalinity are likely to have a considerable effect. It has so far been presumed that any alkalinity of the glass will end in neutralising part of the acidity of the fruit juice, or squash, thereby resulting in the formation of salts which might bring about the coagulation and settling of the colloidal suspension in the product. Apart from any neutralization of the acids of the product, the alkalinity of the glass, especially the high pH at the inside surface in contact with the product, is likely to play an important role in the so-called non-enzymatic browning of fruit juices and squashes. The Maillard or browning reaction between sugars and amino acids, which occurs in 'near-dry' systems and at a high alkaline pH range, may be facilitated near the surface of the glass where the pH is high, although the juice or squash as such has a pH in the acid range. This may be a possible explanation for the occur-

ence of non-enzymatic browning, which occurs in a highly acid medium like a fruit juice or squash in glass containers. This, however, requires a critical investigation. It would be interesting to make a comparative study of this browning discoloration using different types of containers like glass, tin, plastic, etc. We have already undertaken some work of this type using tin cans. The possibility of coating the surface of the glass with protective films like those of silicones, similar to the lacquering of cans, requires a fuller investigation, although this may increase the costs considerably.

The ferrous and ferric iron content of the glass, especially in relation to the restriction of transmission of Infra Red and Ultra Violet radiations, may have a profound bearing on the susceptibility of the constituents of juice or squash to thermal and photochemical reactions. The slight blue or yellow colour of the glass bottle, which is due to the presence of iron in the ferrous or ferric condition, may not always be an unmixed disadvantage because it can be of help in mitigating any possible deleterious effects of radiations in these ranges. This aspect also requires careful study. The 'black-neck' formation in tomato ketchup packed in glass bottles in another problem facing the industry. Our recent investigations, using natural as well as model systems, have, however, shown that the presence of oxygen in the headspace of the bottle is a major factor in this case. This may be aggravated by a faulty closure. The presence of iron in the medium also influences this ring formation, as shown by our experiments carried out in sealed Pyrex glass tubes. The role of the composition of the glass of the bottle in this reaction has, however, to be studied critically.

Importance of Closures

As regards jars and bottles for the other products which are not heat-processed, their shape, appearance, dimension and resistance to mechanical shock during filling, packing and transport, are of primary importance. In this connection, it may be emphasised that the glass container without the closure is only half the show. The closure, whether it be a crown-cork, a clip-on metal lid, a metallic screw-cap or a roll-on seal, is as important as the glass container for

packing the preserved products. This important fact appears to have not been appreciated universally, as is evidenced by the presence on the market of various types of bottles and jars with ill-matching or unsuitable closures. Any improvement in the design and fabrication of glass containers for the fruit preservation industry should necessarily be accompanied with simultaneous improvement in the closures as well.

Standardisation of Glass Containers

The wide range of glass containers in vogue at present in the country for packing different fruit and vegetable products by different concerns has militated against any standardisation and rationalisation of a smaller number of containers and closures best suited for the purpose. In other countries like the U.S.A., where the production of any one product by any one manufacturer is very high, it is possible to maintain individuality and distinctiveness of the container, since there is scope for production of any such container in such large quantity as to make it economical.

At the moment, the tomato ketchup bottle appears to be the only one that has been generally adopted in this country. The same principle will have to be extended to other products also, although it may mean a little subjugation of the individuality, because the crying need of the preservation industry today is the capacity to produce more and more of preserved fruit and vegetable products in a better and cheaper way so that they can reach a wider section of the people. The reduction in the number of different shapes and sizes of glass containers will facilitate their production at cheaper cost from material of better quality and thereby indirectly lower the costs of the preserved products themselves. Only then, will it be possible to lay down effective standards and specifications, chemical as well as physical, for glass containers for the fruit preservation industry. The development of such containers requires the whole-hearted support and co-operation of the glass and closure manufacturers, the fruit preserver and the research worker.

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Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during October–November, 1959 are given in this section.

S (IS) 1

Mycological aspects of diastase production, by T. N. Ramachandra Rao (October 6, 1959).—Introducing the subject, the speaker said that enzymes find wide and extensive employment, in scientific investigations and clinical practice as reagents, in medicine as physiologically active drugs and in industry as biochemical catalysts which promote saccharifications and other types of hydrolytic degradations. He then listed a few of the enzymes such as diastase, invertase, protease, pectinase, amino acid decarboxylase and glucose-oxidase as instances of enzymes used in industry and research.

The production of diastase from microbial sources has formed the subject of numerous investigations from 1887 onwards. Manufacture of enzymes from microbiological sources, possesses the exceptional advantage that within certain limits the production can be strictly controlled. The speaker then referred to the work on the production of diastase by moulds carried out in foreign countries and gave detailed background information of the findings by Indian workers at various centres in the country.

The main problem of the mycological aspects of the production of mould diastase starting with wheat bran was then taken up for detailed study. Starting with a new isolate of *Aspergillus oryzae* isolated from a mixed *Koji* culture, the speaker outlined step by step the mycological aspects of the method for good yields of diastase. The need for preparing a dry spore inoculum and for keeping the moisture in bran as low as possible was emphasised. It was pointed out that after the two stage fermentation,

the moldy bran could be dried to a moisture content of 12 per cent and kept for future use.

The enzyme was extracted in cold and precipitated with 70 per cent ethyl alcohol. The limitations of other solvents like methyl alcohol and acetone as precipitants were discussed. The enzyme precipitate was treated with 95 per cent ethyl alcohol and later on by acetone to remove residual moisture. The dry enzyme powder had a nitrogen content of 3.48 and could hydrolyse 60 times its weight of soluble starch under experimental conditions.

The talk was followed by an interesting discussion in which the following important points were raised: whether there was any difference in the nature of enzymes obtained by the new method as compared to literature values, whether the new process gave improved yield, possibility of varying the culture strain to get maximum yields, *cholan* malt residue as a good substrate for *A. oryzae*, possibility of any contamination from outside when the moldy bran was kept for 36 hours, use of EDTA as a better reagent in testing for copper, whether the process was going to be economical in view of the large amounts of alcohol required, whether the product was comparable to standard preparations, the special advantages of selecting wheat bran, whether any treatment was needed to maintain the potency of the organism, need for more detailed study about the presence of copper, whether adsorbents could not be used in place of solvents and whether the enzyme activity was in the mycelium or in the spore.

Winding up the discussion, the President said that besides inorganic N serving as nutrient, the

presence of protein was also useful in enzyme production. The aim should be to get maximum yields. He said that the mouldy residue could also be used in some ways. He stressed the need to find out whether the enzyme preparation had any activity other than that of amylase. The use of micro-organisms like *A. oryzae* to break down oilseed meal proteins should be investigated. He referred to the enormous amounts of alcohol that would be required as a limitation of the process. Possibility of concentrating the aqueous extract of the moldy bran, adsorbing the concentrate on some adsorbent chemicals and finally eluting should, therefore, be studied. He concluded by saying that the object should be to get an enzyme preparation, which had concentrated activity, was cheap and pure.

S (IS) 2

Analysis of trade grades and trade wastes of pepper, by C. T. Dwarakanath, (October 24, 1959).—The speaker gave a brief summary of the results presented in two earlier seminars which brought to the fore the problem of varieties in pepper grown in India. With an annual production of 26.6 thousand tons in 1957-58, India exported 13,600 tons of pepper earning about three crores of rupees. Even though the quantity of pepper exported has largely been constant, yet there has been a significant decrease in value. It was therefore thought necessary that ways and means should be sought for the economical utilization of trade waste of pepper industry.

Many of the importing countries have laid down standards for black and white pepper, and hence it was

desirable to analyse Indian trade grades and compare them with those of Malaya.

The speaker then presented detailed data about the analysis of standard trade grades of India and Malaya as well as insect and fungus infected pepper. In addition to the above samples, analysis of three types of trade wastes, namely 'Pepper Stems', 'rejections' and 'Varagu' was also presented. The results revealed that all our samples of trade grades of black and white pepper were well within the standard limits prescribed by various importing countries. Fungus and insect infected pepper have not suffered much damage in their essential constituents and hence could safely be reclaimed.

Referring to the waste products of pepper industry, the speaker said that these materials were characterised by high fibre, low starch and high total ash contents. Pepper-rejections proved an exception in that it showed high values both for ether and alcohol extract thereby indicating its possible use for extracting the oleoresin.

The speaker then outlined the old method for determination of 'crude piperine' in pepper by nitrogen estimation and compared it with the more recent spectrophotometric method. The analytical data on piperine estimation for 10 varieties, trade grades and also trade wastes of pepper, was presented. The results revealed that piperine values by the spectrophotometric method were lower when compared with the values obtained by the nitrogen determination in non-volatile ether extract. The higher values in the latter case might be due to other nitrogenous substances present in the oleoresin.

Supplementing the talk, Dr T. N. Ramachandra Rao stated that the recent trend, particularly in U.S.A. and Canada, was to use stabilized oleoresins of pepper both for culinary purposes and in food industries such as meat packing and pickling. He concluded by saying efforts were being made to process

an oleoresin of standard quality acceptable for export trade which retained in full the 'aroma' and 'bite' factors of pepper. These oleoresin concentrates could be either from pure pepper or from rejections with suitable blends to retain flavour of the original product. It was pointed out that every effort would be made to utilise the 'Pepper rejections' for this purpose, thus finding an economic use for one of the trade wastes of pepper.

The discussion that followed the talk centred round the following points: whether the oleoresin was soluble in water or acetic acid so that it could be used in tomato ketchup industry, how the results compare with the specifications of the Central Committee for Food Standards, hygroscopicity of pepper-sal as compared to that of salt, the reason for the low export earnings in spite of the Indian pepper conforming to the standards laid down by importing countries, extent of variation of components in different pure varieties, stability of piperine in the oleoresin, Indian specification for pepper, countrywise distribution of export, whether there were any standards prescribed for fungus infected pepper, the nature of carminative principle in pepper, whether pepper rejections were being exported from India, the size of white pepper industry in India and how the white pepper rejections are being utilized, the type of package required for the oleoresin, possibilities of using green pepper in the pickling industry, the nature of volatile principles of pepper, the solvent used for the extraction of oleoresin, the composition of oleoresin and whether any synthetic preparation of piperine was available.

Winding up the discussion, the President said that the medicinal and therapeutic properties of pepper should be studied so that it could stimulate increased market for pepper. It was necessary to make more concentrated efforts to improve the trade with U.S.A. Referring to the fungus infection of pepper, he said that acetic acid extracted

oleoresin could be used for surface coating to prevent fungus growth on pepper and emphasized the need for work on that line. He stressed the importance of increasing the size of our white pepper production by using chemical or mechanical methods so that it could help in gaining attention of foreign markets. The surface coat left over could also be properly used. Extraction of oleoresin from pepper should be tried on bulk level and utilization of the extracted residue should also be thought of. Summarising, he said that production of fungus-free coated pepper, increased production of white pepper and using the coat for oleoresin extraction, proper packaging of the oleoresin and ban on export of pepper rejections but export of the oleoresin obtained from them should be encouraged. The keeping quality of pepper-sal should be investigated. He referred to the non-availability of a real free-flowing salt as main difficulty in producing such a product. He concluded by saying that there could be a greater demand for concentrated product having all the aromatic principles of pepper.

S (IS) 3

Effects of proteins and protein foods in glucose tolerance, by M. V. L. Rao (November 18, 1959).—In the preliminary introduction of the subject, the speaker briefly outlined the physiological mechanism of the control and regulation of blood sugar levels in the animal body and emphasised that insulin—the anti-diabetic hormone of the pancreatic gland—was the prime factor in this physiological regulation. A relative insufficiency of insulin is the main underlying cause of diabetes (Diabetes mellitus). The present investigations, it was mentioned, had their origin in the preliminary observations recorded by Dr Srinivasan in the 'Lancet' (August 1957, pp. 317-320) about 2 years ago.

In furthering the programme of researches on dietary proteins in relation to glucose tolerance and

the treatment of diabetes, the first question to answer was whether the observed favourable influence of certain proteins like casein and the field bean proteins was due to any interference with the rates of absorption of carbohydrate from the gut or to stimulation of utilisation by the tissues. With a view to elucidating this point, suitably phased intravenous glucose tolerance tests were carried out on a normal subject after the oral ingestion of various proteins and protein foods. The intravenous load of glucose was 25 g. of a sterile 50 per cent solution, which was administered within 1-1½ minutes. 25 g. of the proteins or its equivalent of the protein foods, were fed an hour before the intravenous injection. The results were illustrated by means of graphs which clearly indicated the profound effect of certain proteins on the utilisation of glucose in this test. Casein exerted the maximum effect in this respect, gelatin was ineffective and the pulse proteins (field bean, black gram, red gram and Bengal gram) had an intermediate effect. The data provided clear-cut evidence in favour of the view that the observed effect of the proteins on glucose utilization was not due to any interference with the intestinal absorption of carbohydrates. The effect, therefore, had to be explained in terms of the enhanced utilisation of carbohydrates brought about by the digestion products of the proteins (amino acids and or peptides).

Next, data relating to the influence of individual as well as mixtures of amino acids in the proportions as present in 25 g. of casein on oral and intravenous glucose tolerance in 3 normal individuals was presented. Of the amino acids tested, only L-leucine had an effect comparable with that of the proteins. At a dose of 4 g. there was practically no elevation in the blood sugar level after the oral ingestion of 70 g. glucose for a period of 2-2½ hours. These results confirmed the previous observations of Cochrane *et al.* (7).

Clin. Invest., 35, 411, 1956). However, in contrast with their results, iso-valeric acid, an intermediary metabolite of leucine, had only a slight effect. Both L-leucine and iso-valeric acid had little effect on either the fasting blood sugar level or the glucose tolerance in a confirmed case of diabetes.

During the past 3 years and more, a few well-established diabetics had been kept for fairly long periods on dietary regimens which included liberal supplements of casein, skim milk powder and pulses like black gram and field bean. Their diabetic status as well as general condition were observed from time to time. These preliminary observations indicated that these protein supplements influence very favourably the fasting blood sugar levels, the glucose tolerance and the general condition of the subjects. In advanced cases, the insulin requirements could be gradually reduced to a minimum of 20 units plain insulin per day and in the less advanced cases, it could be completely dispensed with when the patients were on the protein supplemented regimen. Typical data relating to such long-term influence of dietary protein supplements were presented. It was emphasised that extended clinical trials on a large number of well-controlled groups were necessary to confirm these observations and determine the extent to which dietary protein supplements would help to reduce the insulin requirements in various types of diabetics. The long-term effects of feeding such large protein supplements would also have to be ascertained.

Some preliminary observations were also presented on the influence of the vegetable, Knol-khol (*Brassica oleracea caulorapa*) on blood sugar levels and glucose and starch tolerance in a diabetic as well as in a normal individual. Ingestion of 100-150 g. of the cooked vegetable lowered the fasting blood sugar of the diabetic by 30 per cent and accelerated the utilisation of glucose in the sugar tolerance tests. In the

normal individual, however, these effects were not evident.

Discussing the possible mechanism by which orally ingested proteins may accelerate glucose utilisation in the normal as well as diabetic organism, the speaker mentioned that it may involve: (a) priming of additional insulin secretion, (b) potentiation or prolongation of the action of insulin, (c) the suppression of gluconeogenesis through inhibition of glucose-6-phosphatase of the liver or enhanced utilisation of glucose through acceleration of hexokinase action, (d) other independent influences on carbohydrate metabolism and (e) influence on other hormones involved in the glucostatic mechanism. It was stated that casein hydrolysate and leucine and other amino acids had been tested for their influence on glucose-6-phosphatase activity *in vitro*. There were no observable inhibitory effects. Their influence on the hexokinase system was under study. The speaker explained that the rat-diaphragm technique was being standardised for studying both the plasma insulin activity as influenced by various dietary proteins and amino acids and also the possible effect of protein split-products on glucose utilisation and the influence of insulin thereon. Experiments on totally depancreatized dogs have also been contemplated.

It was emphasised that the results obtained with leucine should not be interpreted to mean that the effect of the proteins was equivalent to their leucine content, particularly because leucine was not effective in the case of the diabetic tested. Both leucine and proteins had to be examined independently. A complete explanation of the effect of proteins would have to take into consideration the rate and pattern of release of peptides and amino acids during proteolysis in the gastro-intestinal tract, especially in the initial phase, and the effect of the resulting products on glucose utilisation. Experimental work on this aspect formed part of the future programme of work.

In the interesting discussion that ensued, the questions mainly centered round the meaning of the results presented in the practical terms of treating diabetic subjects. The additional points raised related to the effect of vegetables and other plant materials influencing glucose utilisation in the diabetic, the effect of differences in digestibility explaining the varying effects of the different proteins on glucose tolerance, the hypoglycemic effect of bile salts and its possible relation to the observed effect of proteins, etc. Also, it was suggested that in studying the mechanism of action of proteins and amino acids on glucose utilisation in normal and diabetic subjects, the possible changes in plasma protein fractions brought about by the large protein supplements fed and the influence of these protein fractions on the binding of insulin in the plasma have to be taken importantly into account.

In answering the questions raised the author made the following points: A number of plant materials had been reported, from time to time, to be useful in the treatment of diabetes, but the claims had not been substantiated clinically in many cases. It was difficult to

ascribe the effect of proteins and amino acids to any possible stimulation of secretion of bile salts. The digestibilities of the proteins as well as the pattern of release of amino acids and peptides have to be taken into consideration in comparing their relative influence on glucose tolerance and glucose utilisation. Although the presence of large amounts of peptides in the blood during active protein absorption had not been demonstrated, it is possible that small amounts of catalytically active peptides may be present in the portal as well as systemic blood.

Regarding plasma insulin and its binding by the protein fractions present, it was explained that the contemplated experiments using the rat-diaphragm would give the answer to the questions raised and also indicate whether peptides and amino acids enhanced the utilisation of glucose in the tissues. Answering the question raised regarding certain discrepancies between the levels of blood sugar and the urinary excretion of glucose, it was mentioned that kidney defects, especially with regard to tubular reabsorption of glucose, at times, lead to such anomalous results.

In his concluding remarks, the President complimented the speaker on his lucid exposition and stated that it was necessary, on the fundamental side, to understand more fully the action of proteins and amino acids on blood sugar and glucose utilisation in both normal and diabetic individuals. In addition to the programme of experiments on animals, he suggested that trials may be carried out with partially pre-digested proteins to establish what fraction of the digested protein was responsible for the effect. He emphasised the need for more extensive clinical trials to enable one to formulate satisfactory therapeutic diets for diabetics. He mentioned, in passing, that the results obtained already had attracted the attention of scientists both in India and abroad. The U.S.D.A. was interested in promoting further studies in this line. Their experts were here recently to discuss the plans. He hoped some useful proposals would emerge. He commended the investigators for having made such extremely useful contributions by acting as their own guinea-pigs and wished them all success in the future investigations.

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Fumigation of grains

E (IS) 1

Please arrange to supply literature regarding the newly developed 'calbrix' fumigant pencils to our office at an early date? (Hapur, U.P.)

For large scale fumigation of stored grains in godown and warehouses, ethylene dibromide (a liquid at ordinary temperature) is used

as such in calculated amounts. For small scale trials, when just a few gunny bagful of grains or grains stored in bins have to be fumigated, the fumigant pencils are used. These fumigant pencils called 'calbrix' are absorbent sticks containing requisite amount of ethylene dibromide. Calbrix does not contain any lindane as presumed in your letter. Two fumigant pencils are sufficient

to fumigate one standard gunny bagful of grain. The sticks are introduced into the bag with the help of tongs or a 'calbrix gun' and left in the bag for about a week. Instead of fumigant pencils, ampoules containing calculated quantity of the fumigant can also be used. The bag may be covered with an empty sack or a polyethylene sheet to make it fairly airtight. The

vapours of ethylene dibromide slowly penetrate through the grain and destroy the insects. After one week, the grain is dried in the sun to remove residual vapours of the fumigant, if any.

It may be mentioned here that this fumigation takes care of only the existing infestation. For efficient preservation of food grains, the external infestation or the entry of insects through the bag has also to be prevented. This is done by treating the empty jute bags with an insecticidal formulation called 'Pest-proof emulsion'. By combining the two processes of impregnating the bags and fumigating the grains, further infestation can be easily prevented for about 8-10 months.

The above methods are now being practised by servicing agencies given below:

The Infestation Control Corporation,

Northern Circle:
11 A, Cline Road,
Bangalore—5.

Southern Circle:
38, Mettu Agraharam,
Salem—1.

Drying of chillies

E (IS) 2

I am interested in having a plant for dehydrating 30 maunds of green chillies per day. I hear that driers used in tea industry are suitable for the purpose. Can you let me know as to where such plants are available and what is the most suitable drying temperature? (Nainital)

We have to inform you that for drying chillies, we require a temperature of 60-70° C so that tea driers with suitable modifications can be used with advantage. The manufacturers of tea driers are:

- (1) M/s A. P. V. Engineering Co. Ltd.,
Post Box No. 2492, Calcutta.
- (2) M/s Batliboi and Co.,
Forbes Street, P.B. No. 190 A. Fort, Bombay 1.

Alternatively, if large capacity driers are required, a chamber

with a false bottom (6' dia. × 6' height) may be used and air heated at 60-70° C may be blown from the bottom with a velocity of 2500 c. ft./minute, thus giving 3" S.W.G. pressure and by an appropriate arrangement for partial recirculation of the hot air, an economy fuel consumption can be effected.

Solubility of malt powder

E (IS) 3

The malt powder prepared from ragi does not seem to dissolve completely in hot water or milk. After some time, one can find some solid substance remaining at the bottom. Can you please advise me if there is a method to get the ragi malt dissolve completely? (Bangalore)

With regard to the method to get the ragi malt dissolve, we like to inform you that it is not possible to dissolve any cereal malt either in water or in milk. The best that can be obtained is a thorough dispersion. If the malt is very finely powdered, it can be mixed with hot milk or water, stirred well and used. Even this, on standing, will gradually separate out, though it will take some time.

Guar gum

E (IS) 4

Could you kindly furnish us the information available on guar gum? (Calcutta)

Guar gum is obtained from the seeds of the plant *Cyamopsis tetragonoloba*, which is indigenous to India. The plant grows to a height of about 3-10 feet bearing fleshy pods 1½"-4" long. Each pod contains 5-12 seeds. The plant comes into bearing in 3-3½ months and gives a very good yield. It is grown all over India. The green pods are commonly used as a vegetable and the plant is used as a nutritious green fodder for horses and cattle and also as a green manure crop. The seeds are converted into *dhal*, cooked and fed to cattle with a little mustard oil. The seed is also utilized for the preparation of a gum which is used in food, paper and textile industries.

The gum-containing portion is separated from the outer coat of the seed through milling and the former is made into flour which is the commercial source of guar gum. The soluble part of guar flour consists mainly of galactomannan, containing 34.5 per cent d-galactose anhydride and 63.4 per cent d-mannose anhydride. The flour is dispersible in hot or cold water yielding dispersions with exceptionally high viscosities at low concentrations and possessing 5-8 times the thickening power of ordinary starch. Aqueous dispersions of the gum are neutral in reaction and their viscosity is affected by changes in pH or electrolyte concentration.

Due to its colloidal nature, the gum acts as stabilizer and thickener in food products like ice-cream, bakery mixes and salad dressings. Guar flour is also used in paper and textile industries.

Antioxidants

E (IS) 5

We understand that a mixture of butylated hydroxianisole, propyl gallate and citric acid proves to be the most effective antioxidant for use in the manufacture of biscuits. Will you kindly let us know the proportion in which the above three chemicals are to be mixed to give the desired effect? (Kanpur)

There are several proprietary brands of anti-oxidants such as Tenox II, Sustane, etc. available on the market. These are mixtures of butylated hydroxianisole, propyl gallate and citric acid in different proportions depending upon the particular brand. Tenox II, for example, consists of a mixture of 20 per cent of butylated hydroxianisole, 6 per cent of propyl gallate, 4 per cent of citric acid and 17 per cent of propylene glycol used as a solvent. The maximum amount of the anti-oxidant mixtures to be used in baked and confectionery goods is 0.02 per cent on the basis of the weight of the fat. The anti-oxidant mixture, Tenox II, can be obtained from Messrs.

Tennessee Corporation, 360 N, Michigan Blvd., Chicago-4, Illinois U.S.A.

Manufacture of jelly crystals

E (IS) 6

We shall feel much obliged if you can guide us with the technical aspects of manufacturing jelly crystals. In view of the import restrictions on powdered flavours, we shall be glad if you enlighten us in regard to the use of liquid flavour. Our experiments show that after the jelly made from crystals is taken out of refrigerated box, it starts melting. Is there any stabiliser or chemical that would help in retaining the gel?

We are furnishing below the details of the method of preparation of jelly crystals as desired by you.

Recipe

Sugar	...	85½ lb.
Powdered gelatine	...	12½ "
Citric or tartaric acid	...	2 "
Flavour and colour	...	Sufficient

The flavourings and colours used vary with the type of jelly desired to produce. Depending upon the flavouring added, the appropriate acid, viz., citric or tartaric acid is used. The colour is dissolved in a suitable solvent and then sprayed on to the gelatine powder, the latter being dried down to its original moisture content when necessary and passed through a grinding machine. As the sugar, gelatine and acid are of different particle sizes, they are ground individually to the same size and then mixed in appropriate proportions. If this individual grinding to similar particle size is not carried out, the ingredients are mixed thoroughly in a mixing machine and packed directly from these, avoiding the separation of the various components that would occur if the mixture were handled to any great extent before packing.

You may also refer to the book entitled 'Gelatine desserts and table jellies' by A. E. Williams, published by Food Trade Press Ltd., 7, Garrick Street, W. C. London, a copy of which can be obtained from any of the leading booksellers.

Powdered gelatine of good edible quality conforming to the food standards can be used for manufacture of the jelly crystals. You can also use liquid flavours in the place of powdered ones provided they are in concentrated form. The method of incorporation of liquid flavour is to add it first to one of the ingredients, namely sugar or gelatine and then mix it up with the rest.

As regards the difficulty in keeping the set form of the prepared jelly after removal from the refrigerator, there is no need for any stabiliser. You can probably use the minimum quantity of water in the preparation of jelly during summer while in winter the quantity of water may be slightly increased.

Blended flour

E (IS) 7

I understand that you have developed a blended flour known as 'Paushtik atta' and I shall be thankful to you if you can furnish the details of the same and its nutritive value. (New Delhi)

Investigations conducted at the Central Food Technological Research Institute, Mysore, have shown that a blend of flours (wheat: 75 parts, tapioca flour: 17 parts and groundnut flour: 8 parts) can be used for the preparation of *chapatties* and *purees* in the same way as *atta*. Some trials carried out at different centres in India have shown that the blended *atta* is generally acceptable to wheat eaters.

Blended *atta* will be consumed in place of ordinary *atta*. It is hoped there will be a large demand for the product in areas where *atta* is used as a staple food.

An annual production of 9 lakh tons of blended *atta* will result in a saving of 2.3 lakh tons of wheat which is being imported at present to overcome the food shortage. This will, in turn, result in a saving of Rs 11.5 crores as foreign exchange which will have to be spent otherwise for importing 2.3 lakh tons of wheat. Further, the use

of blended *atta* in place of ordinary *atta* will help to give 25 per cent more food to the people and this will in turn help to overcome the food shortage.

The nutritive value of blended flour is given below:

Nutritive value of blended flour (values per 100 g.)

Calorific value	...	...	352
Protein	...	...	13.35
Fat	...	...	2.04
Carbohydrate	...	...	70.00
Calcium	...	...	0.046
Phosphorus	...	...	0.294
Iron (mg)	...	...	6.73
Thiamin (mg)	...	...	0.51
Nicotinic acid (mg)	...	...	5.62
Riboflavin (mg)	...	...	0.13

Synthetic fruit powder

E (IS) 8

Please inform us the process of manufacturing synthetic fruit powders like lime, orange, pineapple, etc. (Bombay)

To make synthetic fruit powders, citric acid, sugar, flavouring oil and colour are essential ingredients. The proportions will vary according to the taste but, as a general recipe, the following can be tried:

Citric acid	...	1½ lb.
Granulated sugar	...	5 lb.
Terpeneless oil of lemon or orange or pineapple oil	...	¼ fluid oz.
Colour	...	as desired

Instead of citric acid, tartaric acid can be used with advantage as it will prevent caking of the powder.

Take the solids and dry them well before mixing. Mix a little of sugar with three times the acid and put into mortar and spray or drop the flavouring oil over it slowly mixing well. The colour should now be dissolved in the flavouring mixture. When all have been added, gradually add the remainder of the sugar and acid mixing well after each addition. When well mixed, stir often until powder is dried out sufficiently to admit packing. Then put in cans or air-tight packets.

Notes and News

STATISTICAL NOTES

Food Production Statistics for July and August, 1959

Name of Industry	Units of measurement	July 1959		August 1959	
		No. of units	Pro-duction	No. of units	Pro-duction
1. Biscuit ...	Tons	33	1,821	33	1,842
2. Confectionery ...	"	38	934	38	1,061
3. Flour Milling ...	"	55	72,807	56	75,899
4. Butter ...	"	5	71	5	101
5. Cashewnut ...	"	8	1,551	8	1,363
6. Gram flour and Dal...	"	1	365	1	340
7. Aerated water ...	Gross bottles	36	79,386	35	77,843
8. Beer ...	Bulk gallons	2	1,88,407	2	1,39,232
9. Indian made foreign liquor ...	"	18	27,829	14	47,964
10. Country spirit ...	L.P. gallons	15	4,13,900	17	2,11,203

(Ministry of Commerce and Industry, Government of India)

NEWS BRIEFS

Water absorption of flours varies with starch damage: Type and composition of wheat, method of milling, and degree of extraction are important factors influencing water absorption of flours.

Measurements of absorption on 23 samples from 2 English wheats, Atle (hard wheat) and Hybrid 46 (soft wheat) showed variations from 47.1-50 per cent for the latter and from 52.1-53.98 per cent for the former.

Differences in protein content, and amount of damaged starch present accounted for 90 per cent of the absorption differences. Starch damage is greater with the hard wheat and increases with the protein content (*Food Engng.*, July 1959, p. 91).

Factors influencing yield of beta-carotene: Production of beta carotene by fermentation of cereals with fungi is affected by types of grains and by addition of lipids, β - or α -ionone and certain non-ionic surface active agents to the medium.

Paired cultures (plus and minus mating types) of *Biakeslea trispora* were used to inoculate the hydrolyzed grain medium which was incubated for 6 days at 83° F. on rotary shaker.

Highest yields of α -carotene, (35-40 mg./100 ml. medium) were obtained with hexane extracted soybean oil medium as base nutrient. Approximately 95 per cent of total carotene was all-trans- β .

Oils and fats containing large amounts of oleic and linoleic acids such as cottonseed and soybean oils, white or brown greases, also increased the yield. Choice white grease (4 per cent in medium) yielded 40.5 mg. carotene/100 ml. compared to 0.155 mg. in control medium.

A number of surface active agents also gave larger yields. Triton-X-114, for example, induced a yield of 41-75 mg. per 100 ml. (*Food Engng.*, August 1959, p. 91).

Solubility of dry whole milk upped with low-melting fat: Control of physical properties of the fat component of milk may provide a means of preparing a whole milk powder with the wettability and dispensability of a superior grade instant skim milk powder.

This was indicated by experiments with reconstituted milks made from fresh skim and low-melting fractions of butter oil. Skim was heated to 145° F, butter oil sufficient to produce dry products of 25 per cent fat was added, and the mixture homogenizer at 3,000

psi. Resulting material was condensed to 42 per cent solids and spray dried.

Three lots of powder were prepared containing fats with melting points of 19-21°C, 22-24°C, and 28-30°C respectively. The fourth contained unfractionated butteroil. Powders were instantized in a Blaw-Knox unit, screened to uniform sizes, stored for 48 hours and reconstituted in 75°F water.

Product No. 1 (fat m.p. 18-21) showed approximately the same wettability and dispersability as commercial instant skim powder. As melting points of fat components increased, wettability and dispersability decreased rapidly, indicating a definite relationship between fat m.p. and solubility (*Food Engng.*, August 1959, p. 91).

Enzymatic fish cleaning: An improved cleaning method in which intact fish is freed from external scales and internal viscera by enzyme action, has been developed at Texas Eng. Expt. Station.

As it eliminates need for much of the hand labour associated with present methods, the new technique should increase the economic value of small trash fish now caught in the shrimp's trawl.

Most satisfactory enzymes are protein splitting ones of bacterial origin. Action is speeded by increases in temperature and concentration of the enzyme. However, temperatures above 130°F. produce undesirable soft products (*Food Engng.* August 1959, p. 92).

Mushroom washer: Due to their delicate nature, mushrooms cannot be washed in commercial vegetable cleaning units. But proper washing action can be obtained by gently rubbing them together while floating in a cushion of water.

A washer was designed employing an agitator comprising foam rubber-lined teeth mounted on an 8-in. slotted bar that moves in an elliptical path. In operation, mushrooms are gently fed into a tank of water and held beneath the agitator

as it first moves downward, then toward the discharge flight. Agitator then lifts allowing mushrooms to rise. This shifting produces gentle rubbing that shears off the discoloration sensitive hyphal strands (*Food Engng.*, August 1959, p. 95).

New milk whey beverage: 'Rivella' is a health drink recently introduced to the U.K. from Switzerland. The beverage is derived from whey, is non-alcoholic and is flavoured with herbs and fruit. A low pH value of 3.2 has made it suitable for patients with a low stomach acidity, and for diminishing symptoms associated with hyperacidity because of its lactic acid and mineral content. The process for manufacturing Rivella depends upon a biological non-alcohol fermentation of milk whey. It is pasteurized. (*Food*, July 1959, p. 271).

Apple juice: A new concentrated apple juice is being produced by recently developed vacuum freeze-drying techniques. The apple juice called 'Dapple' is said to be more highly concentrated and contains more vitamin C per fluid ounce than any other pure fruit juice concentrate on the market. The difficulty of preserving apple juice without fermentation has been overcome by vacuum freeze-drying techniques (*Food*, August 1959, p. 320).

New water-soluble foodstuff preservative: Potassium sorbate, the potassium salt of sorbic acid, is now being supplied in trial quantities by the Farbwerke Hoechst, Frankfurt (Main) as a foodstuff preservative, in the form of a fine, white crystalline powder. This substance is very soluble in water, solutions containing over 50 per cent of the salt being obtainable. This is of great advantage when it is preferred to use water-soluble or liquid preservatives, e.g., for cucumbers, pickles, fruit juices and pulp, syrups, jams, delicacies, and margarine. The active principle in potassium sorbate is the sorbic acid, which has good antimicrobial properties and is at the same time entirely harmless to the human

metabolism, which digests it like the fatty acid of an ordinary food. Equally with sorbic acid, the potassium salt performs well in the slightly-acid, mild-tasting products preferred at present. The proportions required for preservation are small, and without effect on odour or taste of the most delicate food-stuffs (*Food*, August 1959, p. 323).

Properties of ficin: The proteolytic enzyme or enzymes of fig latex, ficin, has been shown to have properties which make it suitable for use as a meat tenderiser and a clarifier of beverages. It also coagulates milk rapidly. This latter property could be of considerable value in countries where there is an objection to slaughtering calves for the production of rennin.

The work carried out was divided into two phases, one studied the effect of changes in the substrate solution and the other studied the effect of changes in the enzyme on the milk coagulating ability of ficin. The objects were to find out the component responsible for the coagulation and determine whether this was any different from the component responsible for the proteolytic activity.

The clotting time for the action of ficin on milk was influenced by the enzyme concentration, pH, volume of substrate, substrate concentration, age of substrate and temperature. The milk clotting activity of ficin is inhibited and activated by the same reagents which inhibit and activate the proteolytic activity. The milk clotting activity is dependent upon a free sulphydryl group in the enzyme (*Food Manuf.*, August 1959, p. 320).

Foam curtain for citrus fruits: A thin coating of wax applied to the skin of citrus fruits after harvesting retards shrivelling by reducing water loss, and gives the fruit an attractive lustre. The cleaned fruit is usually passed through a tank containing a blend of waxes suspended in a water emulsion. Costly replacement of the emulsion from time to time is necessary. Unless a by-pass is built, all fruit must go

through the waxing tank, although for some, waxing may not be required. The method, devised at the Citrus Experiment Station of the University of Florida, has been tested and improved at Gosford and simplified equipment has been developed for easy application in Australian citrus packing houses. The cost per bushel of oranges is less than a penny, compared with two or three pence for the diptank method.

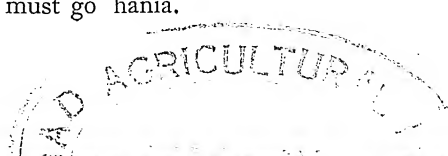
After washing, the fruit passes over a set of rollers driven at about 170 r.p.m. under a tank containing wax emulsion. If waxing is required, air is blown into the tank causing the emulsion to drop down a spillway as a foam curtain on to the fruit revolving on the rollers. The spinning action, together with the jostling of the fruits against each other in the foam, ensures a complete and uniform coating of wax. The fruit then passes through a hot-air drier (*Food Technol. Austr.*, August 1959, p. 434).

INDIAN PATENTS

(A few of the Patent Applications notified as accepted in Part III, Section 2 of the Gazette of India, from 25th April to 30th May 1959 are given below:)

63708. Thermally insulated food containers: Comprising a housing, a lid, walls of lid and housing thermally insulated, and within housing is a casing with a cover and at the inside of lid is fitted a device for pressing cover of casing and closing mouth of tube in cover of casing, the casing holding food containers.—Patented by Director of Research and Development (General), Directorate of Technical Development, Ministry of Defence, Government of India.

66094. Improvements relating to dry syrup powder composition: Comprising an intimate mixture of pulverised sugar, saccharine, tartaric acid, sodium bicarbonate, an edible colouring material and an essential oil.—Patented by J. K. Dhandhanania.



61309. *Plant growth regulating compositions comprising tetra-halobenzenes compound:* Containing 2, 3, 5, 6-tetrahalobenzoic acid derivatives.—Patented by E. I. Du Pont De Nemours and Company.

61365. *Process for dehydrating viscous solutions of vegetable flours:* Passing high frequency oscillating electric circuit through thin layer of solution between two electrodes.—Patented by H. Hefti.

61366. *Process for the chemical conditioning of flours:* Flour admixed with chemical agents is passed between electrode of capacity inserted in high frequency oscillating circuit.—Patented by H. Hefti.

61367. *Process and apparatus for decorticating seeds:* By exposing to intense heat radiations and brushing.—Patented by H. Hefti.

62166. *Process for the separation of the skin of guar seeds:* Treating with hydrochloric or boric acid salt solution and subjecting to friction mechanism and aeration.—Patented by Industrias Cemar, S.A.

62596. *Flavouring substances and their preparation:* Heating an amino-reagent comprising cysteine with fractionated liquid wood smoke, in the presence of water.—Patented by Unilever Limited.

61484. *Improvements in or relating to the refining and utilization of cottonseed oil:* Treating with aqueous solution of borat or sodium borate prior to alkali treatment.—Patented by the Council of Scientific and Industrial Research.

62262. *Improvements in or relating to the detoxification of cottonseed products such as cottonseed meal or cottonseed flour:* Treating with aqueous solution of borax or sodium borate to remove gossypol.—Patented by the Council of Scientific and Industrial Research.

63243. *An acaricidal composition:* Containing 0.01-80 per cent by wt. of poly-halogen- diphenylsulphones, -sulphorides or -sulphides with diluent or carrier.—Patented by N. V. Philips' Gloeilampenfabrieken.

64353. *Improvement in the manufacture of furan compounds:* Reacting furfural with hydrogen in the presence of a catalyst consisting of oxides of copper and chromium, said reaction being conducted in a fluidised bed.—Patented by the Council of Scientific and Industrial Research.

FOREIGN PATENTS

2,883,286. *Chocolate foam topping:* A method and formula for the manufacture of a chocolate flavoured topping is the object of a recently granted patent. Topping is prepared by mixing and dispersing together chocolate flavour, fat, sugar, and concentrated milk. Flavouring agent may be cocoa or chocolate liquor. Concentrated milk may be made by mixing dry milk with water or with whole milk. Above mixture is then packaged under gas pressure so that when it is dispensed it will be aerated into a foam-type topping (*Food Engng.*, July 1959, p. 91).

2,893,878. *Protecting colour, flavour of dehydrated potatoes:* A process for inhibiting non-enzymatic browning of dehydrated potatoes, without adversely affecting their flavour during prolonged storage at room temperature is the subject of a recent invention. Crux of the method is spraying the cubed, steam-blanching potatoes with a mixture of CaCl_2 and a water soluble sulfiting agent. Latter may be Na_2SO_3 , NaHSO_3 , K_2SO_3 , KHSO_3 , or mixtures of 2 or more of them. Sufficient solution should be applied to ensure presence of at least 0.1 part Ca ion and 0.015 parts sulfite ion per 100 parts by weight of the dehydrated potatoes (*Food Engng.*, August 1959, p. 92).

813,114. *Edible sodium chloride composition:* An edible sodium chloride composition which has superior storage properties is described, which is stabilised against the absorption of moisture and which comprises an edible grade of sodium chloride and a small amount of finely divided sodium aluminium silicate having a particle size below

0.1 micron and a surface area of 10-200 sq. m. per g. Analyses of preferred sodium aluminium silicates are given and an addition of 0.5-1 per cent by weight is recommended.—Patented by Columbia-Southern Chemical Corporation (*Food Manuf.* August 1959, p. 328).

813,341. *Packaging and distribution of fish:* A method is described for packaging fish and in particular a kipper, in which the fish is packed in a wrapper together with a piece of a material such as cardboard for support, the fish being secured to the support either by passing its head and or tail through a slot in the support, or by non-corrosive staples. For distribution, these packaged fish may be packed vertically in layers and, as a result of the use of the support, the lower layers are not deformed or crushed by the dead weight of the upper layers.—Patented by Maconochies' Kippers, Ltd. (*Food Manuf.*, August 1959, p. 328).

813,402. *Vegetable fat for margarine:* A fat suitable for use in margarine compounding, which consists of either a physical mixture of or the product of interesterifying a mixture of (a) a glyceride oil of the coconut oil group, (b) 1-15 per cent lower fatty acid glycerides and (c) 1-15 per cent palmitic acid glycerides, is described. It is stated that these fat compositions are suitable for preparing margarines which have excellent taste and flavour, which retain a butter-like plasticity at refrigerator temperatures and which possess a butter-like gradual melting at body temperature. It is further stated that the coconut oil glyceride can be hydrogenated either before or after compounding.—Patented by Ernest Francis Drew (*Food Manuf.*, August 1959, p. 328).

C.F.T.R.I. NEWS

Participation in Exhibitions: At the instance of the Council of Scientific and Industrial Research, the Institute decided to participate in the World Agricultural Fair, New Delhi, which opened on December

11, 1959. The stall was arranged and decorated by live units operating and manufacturing *on the spot* several products such as multi-purpose food, parboiled rice, vegetable curd, mango cereal flakes, fruit toffees, etc., in addition to the inspiring demonstrations in the simple methods of fruit and vegetable preservation, *idli* making, brewing of coffee, detection of adulteration in coffee powder, waxing of fruits, vinegar generator, refrigeration of fruits and vegetables through walk-in cold storage, optimum storage temperature by push-button device, dufume process, impregnation of jute bags, storage of foodgrains in godowns, commercial and economical serial grain storage technique, models of testing techniques for transport hazards, utilisation of agricultural wastes, model units for: rice bran oil factory, vacuum tester, spin pasteurizer, etc. There was in addition an orderly display of attractive charts (photographic and descriptive), samples of the industry and home scale preservation, and of products developed at the Institute, all of which have been suitably described and brought out in an illustrative documentary brochure styled "*Food Technology in Agriculture*". The stall has won the admiration and praise of national and international leaders and technical people who found an opportunity to visit the same.

The Institute also participated in the Indian National Congress Exhibition, Bangalore, where all national leaders had assembled to chalk out the programme for the planning and execution of country's future.

Visitors: The following distinguished personalities visited the Institute during Dec.,

1959-Jan., 1960 and also addressed the Seminar:

1. Dr. P. F. Pelshenke, F.A.O. Expert in Cereal Technology and Director, Federal Research Institute of Cereal

Chemistry, Detmold (West Germany).

2. Dr. W. H. Sebrell (Jr.), Director of the Institute of Nutritional Sciences, Columbia University, U.S.A.



A general view of the Stall with visitors at the Congress Exhibition, Bangalore.



Smt. Indira Gandhi evincing keen interest in the products at the Institute Stall at the 65th Indian National Congress Session Exhibition, Bangalore.

Information from Foreign Journals

THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

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Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART II (Indian)

ANALYTICAL

Separation and estimation of sugar components of *Allium cepa* Linn. (N.O. Liliacea), by paper chromatography, by Sinha A. and Sanyal, A. K., *Curr. Sci.*, 1959, 28 (7), 281.—The bulb of *Allium cepa* Linn. (English onion) possesses useful medicinal properties. The AA have investigated into the nature of sugars present in the bulb by employing paper chromatographic techniques. For preparing the extract, 100 g. of fully mature onion were crushed, mixed with 100 ml. of distilled water and allowed to soak at 20° C for 24 hours. It was filtered off and the filtrate treated with animal charcoal to remove colouring matter and tannin. The clear filtrate was concentrated under reduced pressure to 10 ml. The concentrate was used for separation and estimation of sugars. The extract was found to contain 2.8 per cent reducing sugars. Arabinose, xylose, ribose and rhamnose were identified in the extract, their amounts being 996.8, 692.7, 657.0 and 450.0 mg. per 100 g. of the sample respectively.

—K.L.R.

On the legal standards for mustard seed, by Dutta, A. B., *J. & Proc. Inst. Chem.*, 1959, 31 (1), 9.—Routine analysis of mustard seed shows that most of the samples fail to satisfy the existing legal standard for volatile oil. The A has carried out a detailed analysis of 40 samples mustard of different species with a view to suggesting fresh standards. The Requet's method has been employed with slight modification by the A for the estimation of volatile oil. It was found that for the estimation of volatile mustard oil of all the varieties

of Indian mustard seeds, the maceration period should not be less than 18 hours at 37° C. It was found that 4 samples yielded 0.60-0.67 per cent volatile essential oil, 17 samples yielded 0.50-0.59 per cent, 12 samples gave 0.40-0.49 per cent, 5 samples 0.30-0.39 per cent and the remaining 2 samples 0.20-0.29 per cent volatile oil. The above figures show that only 10 per cent of the samples satisfy the present legal standard of a minimum of 0.6 per cent volatile oil. The A has suggested that the present standard be decreased to 0.3 per cent for Indian mustard seeds. Standards for other characteristics are also given.

—K.L.R.

A modified method for removing the interfering coal tar dye in oils and fat prior to Villavecchia and Fabris test for sesame oil, by Roy, S. C., Sen, A. R. and Chatterjee, R. K., *J. & Proc. Inst. Chem.*, 1959, 31 (1), 16.—A modified method for the removal of coal tar dye in oils and fats prior to Villavecchia and Fabris test is discussed. The test is carried out with solvent ether and HCl (1:1) in contrast to the usual method of employing HCl (sp. gr. 1.125) only and the advantages of the present method over the latter is shown.

—K.L.R.

BIOCHEMISTRY AND NUTRITION

Nutritive value of pumpkin proteins, by Kamath, S. H. and Kamala Sohoni (Mrs), *Ann. Biochem. exptl. Med.*, 1959, 19 (4), 95.—The proximate composition of fresh pumpkin pulp has been given. The total essential amino-acid composition of sun-dried pumpkin

has been determined microbiologically and it appears that methionine is the limiting amino-acid in case of this vegetable. Peptin, followed by tryptic, digestion of pumpkin has shown that methionine is released to a very small extent but lysine is released to a greater extent than in the case of casein. The nutritive value of pumpkin powder has been assessed by biological methods, by nitrogen balance, by repletion of R.B.C. and haemoglobin, liver protein and xanthine oxidase repletion and filling up of the serum protein compartment. It has been found that the biological value of pumpkin powder is 60 per cent and the true digestibility 72 per cent. For liver xanthine oxidase, serum protein, R.B.S. and haemoglobin, regeneration values have been observed to be fairly comparable to those obtained for casein under identical conditions. For liver protein regeneration, values obtained for pumpkin have been found to be very low. In every case the differences in values for pumpkin were significantly lower than for casein at 5 per cent level of confidence. Electrophoretic analyses of sera of rats maintained on the vegetable and casein diets did not show much difference.

Condensing enzyme in the fruits of *Garcinia xanthochymus*, by Deshpande, W. M. and Ramakrishnan, C. V., *Ann. Biochem. exptl. Med.*, 1959, 19 (5), 111.—Extracts of *Garcinia xanthochymus* fruit tissues have been shown to contain a condensing enzyme through the formation of citric acid from acetyl phosphate and oxaloacetate in the presence of coenzyme A and an *Escherichia coli* fraction as a source of transacetylase. A procedure is

described for the partial purification of the enzyme. The formation of citrate, which is accompanied by the disappearance of a stoichiometric amount of acetyl phosphate, is inhibited by alcoholic extracts of the latex oozing out from *Garcinia* leaves.

Vitamin B₁₂ deficiency and amino-aciduria, by Gokhale, S. K. and Punekar, B. D., *Ann. Biochem. exptl. Med.*, 1959, 19 (6), 159.—Better growth responses were observed in rats receiving vitamin B₁₂, confirming the previous findings that vitamin B₁₂ promotes anabolic processes. Vitamin B₁₂ deficiency in rats has been found to cause amino-aciduria, characterised by increased excretion of free as well as combined α-amino-nitrogen in the urine. Microbiological estimations have shown that the aminoacids excreted in larger amounts in vitamin B₁₂ deficiency are glutamic acid, lysine, glycine, phenylalanine, tryptophan and methionine. It is suggested that the amino-aciduria in vitamin B₁₂ enhances protein biosynthesis by improving the utilization of circulating blood amino-acids.

The superimposition of calorie restriction on protein deficiency—effect on liver, small intestine and pancreas of young albino rats, by Kshirsagar, S. G. and Patwardhan, V. N., *Indian J. med. Res.*, 1959, 47 (1), 64.—A study of the biochemical changes in liver, small intestine and pancreas on protein and calorie deficiencies, singly as well as combined, has been carried out in albino rats. The total nitrogen, succinic acid dehydrogenase and transaminase of the liver were reduced on protein deficiency. On calorie deficiency alone, there was a significant rise in the total nitrogen, succinic acid dehydrogenase and transaminase of the liver. The superimposition of calorie restriction on protein deficiency afforded some protection to the liver as far as the above constituents were concerned. Total N, transaminase and esterase of the small intestine were not affected in

protein deficiency. Succinic dehydrogenase was reduced but not to the same extent as in liver. Alkaline phosphatase in the small intestine showed an increase. None of these changes were further effected by added calorie deficiency. Pancreatic lipase was reduced markedly on 14th day due to protein deficiency. The loss increased with time. Calorie restriction alone brought about a similar change but to a milder degree. The combined deficiency, however, afforded some protection. The added effects of calorie restriction (up to 50 per cent) superimposed on protein deficiency varied from organ to organ.

Studies on lipid metabolism. Part II—Effect of high protein diets on the development of experimental atherosclerosis and the role played by glucose-cyclo-acetoacetate, by Nath, M. C. and Saikia, A., *Indian J. med. Res.*, 1959, 47 (1), 73.—The feeding experiments of high protein diets containing defatted egg albumin, casein and meat at 40 per cent level were performed on rats for a period of 15 weeks. On feeding these high protein diets, hypercholesterolemia has been developed in the plasma and tissues, resulting into elevated C/P ratio; the liver fat and the iodine values have been decreased and the tissue phospholipid lowered. The methionine content of the liver of the animals has been decreased. Hydrolysed glucose-cyclo-acetoacetate (GCA), while injected to the animals fed high protein diets, has been found to cause lower C/P ratio and practically normal levels of cholesterol and phospholipid in the plasma and tissues. Further, these groups have shown increased levels of liver methionine and liver fat with better growth of the animals than those of the animals fed high protein diets only. It has been shown that prolonged feeding of high protein diets at 40 per cent level caused gradual development of hypercholesterolemia and atherosclerosis, which could be checked by the administration of hydrolysed GCA.

Studies of low protein diets on the intermediary metabolism of hepatic ferritin, by Srikantia, S. G., *Indian J. med. Res.*, 1959, 47, (1), 81.—The effect of low-protein diets on the intermediary metabolism of hepatic ferritin has been studied in albino rats and in monkeys. Changes were induced in the hepatic ferritin status in monkeys on a low-protein diet alone, while in rats a superimposed high-fat intake was necessary to bring about these changes. Active ferritin was present in the blood stream of only those animals whose livers showed altered ferritin metabolism. It is suggested that the liver is the source of the active ferritin demonstrated in the circulation of animals maintained on low-protein diets.

Nitrogen balance studies in pregnant women in South India, by Jayalakshmi, V. T., Venkatachalam, P. S. and Gopalan, C., *Indian J. med. Res.*, 1959, 47 (1), 86.—Nitrogen balance studies were carried out at four levels of protein intake on eight pregnant women belonging to the low socio-economic group. These subjects were either in the neighbourhood of N balance or in positive nitrogen balance on an intake of 60 g. of protein per day. By increasing the daily protein intake to 84 g. per day an increase of nitrogen retention was achieved in all subjects. This was not associated with an appreciable increase in faecal nitrogen excretion. With increase of protein intake to 106 g. and 118 g. per day, a further slight increase in nitrogen retention was observed. But this was of a smaller order than the increase observed with increased protein intake from 60 g. to 84 g. It was also associated with appreciable increase in faecal nitrogen excretion. It is concluded that the optimum protein intake in the pregnant women studied here probably lies between 84 g. and 106 g. of protein daily.

Nutritive value of proteins of green vegetables, by Kamath, S. H. and Kamala Sohoni (Mrs), *Indian J. med. Res.*, 1959, 47 (1), 93.—The amino acid contents, rate

of release of soluble nitrogen and essential amino acids from two vegetables—Amaranth (*Amaranthus gangeticus* L.) and Trigonella (*Trigonella foenum graecum* L.)—have been determined in addition to the proximate composition. Amino acids have been assayed microbiologically, nitrogen release was determined using pepsin and trypsin as digesting enzymes and proximate composition determined by standard A.O.A.C. methods. Autoclaving of the powders has been observed to have no effect over the rate of release of soluble nitrogen. Methionine has been found to be the most limiting amino acid. The vegetables were observed to be inferior to casein in their biological value, true digestibility and nitrogen utilization values, at 8 per cent protein level. The values obtained for the vegetable powders in regeneration of serum proteins, r.b.c. hemoglobin and xanthine oxidase have been found to be comparable to those for casein, whereas values for liver-protein regeneration for the vegetable powders were found to be lower than those for casein. It has been found that of the two vegetables, amaranth is superior to trigonella in all the cases except digestibility. Trigonella has greater digestibility perhaps because of its greater concentration of the non-protein nitrogenous fraction. As the rate of release of lysine from the vegetable powders is of a high order it has been suggested that these vegetables may be valuable in supplementing lysine-deficient diets, such as those where cereals are used exclusively.

FRUIT AND VEGETABLES

Blue mold of amla (*Phyllanthus emblica* L.), by Setty, K. G. H., *Curr. Sci.*, 1959, 28 (5), 208.—Amla fruits are commonly affected by certain molds during storage in rooms or market places. The rot produced by the mold is characterized by brown patches at first, which become soft and sunken. As the rot progresses, the whole fruit is affected and exudation of drops of

yellowish liquid on the fruit with a bad odour is observed. The effected portion has been microscopically examined and the organism responsible for the rot has been identified as *Penicillium islandicum* Sopp. The fruit rot can be arrested by careful handling of the fruits to avoid injuries, securing sanitary conditions in the storage rooms by gas treatment and by treating the fruits with mild antiseptics like borax and sodium chloride in very dilute concentrations.

—K.L.R.

MICROBIOLOGY

Bacterial action of formaldehyde solutions in the presence of peptone, by Subba Rao, V., *Curr. Sci.*, 1959, 28 (7), 300.—It is generally believed that the presence of organic matter retards the action of bactericides. In the present study, the influence of nutrients like peptone on the bactericidal activity of formaldehyde solutions has been investigated. *Bacillus subtilis* has been used as the test organism for determining the activity of 0.1 and 0.05 molar formaldehyde solutions in presence of 1 per cent peptone at two different temperatures, namely, 37° C and 25° C. At definite time intervals, the number of spores of the organism surviving has been counted. The results graphically represented in the form of survivor/time curves show that about 60-70 per cent of the spores were killed within 90 min. and the remaining after 180 min. in the case of 0.1 molar solution kept at 37° C. There was no appreciable mortality during the 90-180 min. interval. Similar periods of inactivity was also noticed with 0.05 molar solution at 37° C and 0.1 molar solution at 25° C, when 30-40 per cent of the organisms survived during the interval between 180 and 360 minutes. Addition of spores to the mixture of peptone and formaldehyde previously incubated for 3 hr. at 37° C produced similar results while addition of formaldehyde after incubating the spores in peptone solution for 3 hours killed all the spores within 90 minutes. This

indicates that the inactive phase of formaldehyde solution may be due to the spores germinating during their contact with peptone even in the presence of small quantities of formaldehyde and becoming more susceptible after the time intervals corresponding to the flat portions of the curves.

—K.L.R.

OILS AND FATS

Studies on the influence of amino-acids on sugarcane and sugar recovery—Part I: Quantitative estimation of amino-acids in oilseed cakes, by Sen, S. C. and Prasad, R., *J. & Proc. Inst. Chem.*, 1959, 31 (1), 19.—The AA have qualitatively identified the different amino-acids present in 7 oilseed cakes which are usually used as manures with a view to finding out the most suitable cake for sugarcane cultivation. Pure oilseed cakes, viz., linseed, groundnut, rai, mustard, sesame, castor and mahua were used in the study. The protein hydrolysates of the oilseed cakes were prepared and after suitable treatment they were subjected to paper chromatographic analysis of identifying the amino acids. 18 different amino-acids were detected in the cakes analysed. The number of amino acids found in the different oilseed cakes is as follows: sesame, 16; groundnut and rai, 14; linseed, 13 and mustard cake, 12 respectively.

—K.L.R.

GENERAL

Some important characteristics of genuine betelnut, by Dutta, S. N. and Dutta, A. B., *Curr. Sci.*, 1959, 28 (5), 198.—Adulteration of arecanut is extensively practised and it is difficult to detect the same in view of the absence of any standards. In the present note, some of the important characteristics that would help in detecting the adulteration have been determined. A number of samples of Indian and imported genuine whole betelnut and cut piece of betelnut adulterated with the spurious nut (*Ramsupari*) have been

analysed for moisture, total ash, water extract, alcohol extract, ether-extract, quercitannic acid, arecoline and areca-red. The figures show that the bigger the nut, the greater

is the yield of ether extract and arecoline, whereas it is the reverse in the case of areca-red. There are large differences in the values for the genuine arecanut and the spu-

rious nut so that the figures are helpful in fixing up suitable standards.

—K.L.R.

PART III (Foreign)

ADDITIVES

Subtilin and nisin as additives that lower the heat-process requirements of canned foods, by Campbell, L. L., Sniff, E. E. and O'Brien, R. T., *Food Technol.*, 1959, 13 (8), 462.—Much work needs to be done before the full scope as well as the limitations of subtilin and nisin can be clearly defined, but it may be said that these antibiotics offer many interesting and attractive possibilities in aiding in the control of spoilage of a variety of canned foods. The present U.S. Food and Drug Standards, however, do not permit the use of subtilin or nisin as additives in canned foods. This paper reports the results of a study of the effect of subtilin and nisin on the severity of heat treatments necessary to prevent spoilage of various canned food products inoculated with spores of highly heat-resistant food spoilage bacteria; specifically: the spores of P. A. 3679, *Bacillus coagulans*, and *Bacillus stearothermophilus* suspended in various food substrates. Data are presented which show that subtilin and nisin effectively reduce the thermal process requirements necessary to control the spoilage of several food products.

ANALYTICAL

The micro estimation of γ -(4-chloro-2-methylphenoxy) butyric acid, γ -(2:4-dichlorophenoxy) butyric acid, and n-butyl γ -(2:4-dichlorophenoxy) butyrate in plant material, by Glastonbury, H. A. and Stevenson, M. D. *J. Sci. Fd. Agric.*, 1959, 10 (7), 379.—As residue data on the persistence of herbicides are required for crops grown for human or animal consumption, a method has been developed for the determination of

phenoxyalkane carboxylic acid and ester residues in plant material. This rapid, specific and sensitive method is described with special reference to the determination of 2:4-DB and its butyl ester in lucerne and MCPB in pea plants. (The sodium salts of the acids were always used in the formulations of 2:4-DB and MCPB sprayed in field experiments).

A radioactive isotope dilution technique is used to obtain quantitative results from non-quantitative procedures and infra-red spectroscopic analysis gives the necessary specificity. The sensitivity is 1 p.p.m. of the acids for a maximum sample weight of 200 g. and 2 p.p.m. of ester for a maximum sample weight of 50 g.

The method has been applied in field experiments on residue levels and one typical series of results is given.

Orange-G binding as a measure of protein content, by Bunyan, J., *J. Sci. Fd. Agric.*, 1959, 10 (8), 425.—The relationship between the binding of Orange G from solution and crude protein content has been studied for a number of common protein foods. A range of meat meals and whalemeat meals showed correlation between crude protein and dye-binding, apart from a few completely atypical samples. Among fish meats, soya-bean and groundnut meals, no atypical samples were found. In all five types of materials, dye was bound by other constituents in addition to protein. A number of isolated samples of other protein sources were also studied. Estimates of crude protein content from dye-absorption data were not accurate because of variation between meals of the same type.

BAKERY

Lipase activity in biscuit doughs, by Halton, P., *et al.*, *J. Sci. Fd. Agric.*, 1959, 10 (7) 401.—High lipase activity in flour, which may result from mould contamination of wheat, has been shown to be a cause of the development of a soapy taste in biscuits made from the flour. Three methods may be used to assess whether, as a result of high lipase activity, a flour is likely to give biscuits with such a taint. These methods involve (1) organoleptic tests on a flour-fat dough incubated at 80° F, (2) measurement of the acidity of the fat extracted from such a dough and (3) determination of the counts of moulds and fat-splitting organisms in the flour.

Use of lecithin in production of bread containing defatted soya flour as a protein supplement, by Adler, L. and Pomeranz, Y., *J. Sci. Fd. Agric.*, 1959, 10, (8), 449.—Loaf volume and bread-baking quality can be maintained in bread baked from different types of flour extraction and wheat strength mixed with defatted soya-flour and prepared without addition of sugar and fat, by increasing the level of oxidising agent to the optimum and adding lecithin to the dough. The quantity of lecithin necessary for a 3, 6 and 9 per cent respectively, defatted soya-wheat blend has been determined.

CEREALS

A comparison of the starches from barley and malted barley, by Greenwood, C. T. and Thomson, J., *J. Inst. Brew.*, 1959, 65, (4), 346. Starch has been isolated from barley and malted barley of the same sample of cereal. The malted-barley starch had a higher apparent amy-

lose content, a higher gelatinization temperature, and smaller granules than that from the original barley. Pre-treatment of the granules of both starches with liquid ammonia was necessary to achieve complete dispersion prior to fractionation into their component amylose and amylopectin. The amylose from the malted-barley starch was smaller in molecular size and had a higher β -amylolysis limit than that from the barley. The amylopectin fractions differed with regard to average chain length and β -amylolysis limit, but they were of comparable molecular size. Calculation showed the two amylopectins to have similar internal chain-lengths, but different external chain-lengths, that for the malted-barley amylopectin being smaller. This suggests that the malted-barley amylopectin had been degraded by β -amylase to a limited extent. Sub-fractions of amylose obtained on successive aqueous leaching of both granular starches showed a decrease in β -amylolysis limit with increase in molecular size. The properties of the components from malted-barley starch can be satisfactorily accounted for by assuming limited β -amylolysis of the amylopectin and very limited α -amylolysis of the amylose in the original barley starch.

FISH

Chemical studies on the herring (*clupea harengus*). I.—Trimethylamine oxide and volatile amines in flesh, spoiling and cooked herring flesh, by Hughes, R. B., *J. Sci. Fd. Agric.*, 1959, 10 (1), 431.—Gas chromatography was applied to a study of the production of volatile amines and ammonia in herring flesh under various conditions. Fresh flesh contained ammonia and a small quantity of trimethylamine, but no monomethylamine, dimethylamine or higher amines in the large ethylamine to pentylamine were detected. The trimethylamine oxide content varied according to the season, being higher in winter than in summer.

During storage at 10–13°, ammonia and trimethylamine were formed, and also smaller quantities of di- and mono-methylamine. No higher amines were detected after 4 days. The trimethylamine oxide content dropped over the period. Cooking in sealed glass tubes at 120° resulted in breakdown of trimethylamine oxide, and formation of ammonia, tri-, di- and mono-methylamine (trace). No higher volatile amines were detected in the cooked flesh. The possible significance of the results in relation to the development of flavour in canned herring is discussed.

Use of potassium and sodium sorbate in extending shelf-life of smoked fish, by Geminder, J. J., *Food Technol.*, 1959, 13 (8), 459.—Fish products because of their susceptibility to bacterial, yeast and mold growth have a short shelf-life. Dried, salted, or smoked fish because of their low moisture content are relatively free from bacterial growth. However, they are susceptible to mold and yeast growth. Potassium or sodium sorbate solutions (5 per cent, w/v) can be applied before smoking as a spray or dip (or after smoking as a dip) to fish, resulting in levels of 0.03 to 0.05 per cent sorbic acid based on fish weight. High smoking heats in a nonvented smokehouse did not alter the antimycotic level on the fish. These levels were effective in extending the refrigerated shelf-life of nonvacuum-packaged smoked fish. Normal handling of vacuum-packaged smoked fish frequently results in pouch punctures from sharp fish fins. These punctures provide a point of contamination by yeast and mold spores. Potassium or sodium sorbate solutions sprayed after smoking produced levels of 0.05 to 0.15 per cent sorbic acid based on the fish weight, and inhibited growth of these contaminants. Refrigerated shelf-life of fish in punctured pouches was extended. Solutions containing a mixture of sodium sorbate and sodium isoascorbate inhibit yeast and mold growth and enhance and stabilize the desirable pink-red

colour of smoked salmon. Solutions can be applied before or after smoking.

FRUITS AND VEGETABLES

Ripening of broad beans, by Anthistle, M. J., Ashdown, D. F. and Dickinson, D., *J. Sci. Fd. Agric.*, 1959, 10 (8), 412.—Experiments designed to investigate changes during ripening of broad beans in skin-to-flesh ratio, tenderometer and texturemeter readings, and per cent of alcohol-insoluble solids (A.I.S.), are described, and the results compared with values obtained for changes in leuco-anthocyanin and phenolic contents of the skins. Figures are recorded for two varieties of bean, one white and one green, and show that at any given maturity stage the white bean is superior on the basis of tenderness and A.I.S. content. No correlation between extractable leuco-anthocyanins and toughness of skins was found.

Spoilage of canned peas: A thermophile that affects the artificial colour, by Hall, L. P. and Raven, T. W., *J. Sci. Fd. Agric.*, 1959, 10 (8), 456.—An unusual type of spoilage is described which occurred in canned peas during incubation at 55°. The chief symptom was an alteration of the normal bright green colour of the liquor to a pale blue which changed to purple on exposure to air. An organism recovered from the cans was shown to produce the colour change under suitable conditions, and by culture reactions to be similar to *B. michaelisii*. Liquors from spoiled and unspoiled cans were compared by solvent extraction and by paper chromatography, and of the artificial colours present, the one associated with the observed colour changes was identified as Yellow 2G. An account is given of the reproduction of the colour change by the action of zinc dust. A mechanism is suggested for the reaction.

Nonenzymatic formation of acetoin in canned vegetables, by Rallis, J. W., *J. agric. Fd. Chem.*,

1959, 7 (7), 505.—The concentration of combined 3-hydroxy-2-butanone (acetoin) and 2, 3-butanedione (biacetyl) in spinach, asparagus, beets, and peas is 120 to 300 p.p.m. The acetoin level of blanched, frozen peas was increased from 260 to 340 p.p.m. by heating at 100°C for 15 minutes; heating for 45 minutes caused the concentration of acetoin to drop to 285 p.p.m. The observed increase of acetoin during the short heating period is due to the thiamine-catalyzed conversion of pyruvic acid to acetoin. This reaction was demonstrated with model systems in the pH range and reactant concentration levels found in canned vegetables. There is no simple relationship between thiamine and acetoin contents in canned vegetables. The presence and concentration changes of acetoin during processing must be considered in any explanation of vegetable flavour.

Loss of vitamin C in fresh vegetables as related to wilting and temperature, by Ezell, B. D. and Wilcox, M. S., *J. agric. Fd. Chem.*, 1959, 7 (7), 507.—Fruits and vegetables furnish approximately 94 per cent of the vitamin C in the diet of urban families in the United States. These foods are largely consumed fresh; temperature and humidity are primary factors in their preservation. Kale, collards; turnip greens, spinach, rape, cabbage, and snap beans were subjected to slow, moderate and rapid wilting at 32°, 50°, 70° or 75°F. Conditions favourable to wilting resulted in a more rapid loss of vitamin C. Vegetables that lose moisture readily and wilt appreciably tend to be affected more by humidity and to lose vitamin C more rapidly than those resistant to wilting. Even those that wilt most readily are affected much less by humidity than by temperature.

Debitting of grape fruit products with naringinase, by Griffiths, F. P. and Lime, B. J., *Food Technol.*, 1959, 13 (8), 430.—Exploratory studies by the U.S.

Fruit and Vegetable Products Laboratory on the action of naringinase when used to debitter grapefruit pulp and juice, demonstrated that neither the original Davis test nor the modified test proposed by Ting necessarily correlated with actual bitterness. It was found that partially hydrolyzed pulp and juice gave high Davis values without a correspondingly high bitter flavour. In determining the effects of enzyme activity on bitterness, or in comparing bitterness of canned juice prepared from fruit of different maturities, it was found necessary to rely more on taste evaluation than upon results of the Davis test. This study reports on conditions affecting the use of naringinase in debittering grapefruit pulp and products as determined by taste evaluation and Davis test. Conditions of optimum enzymatic hydrolysis of naringin in grapefruit pulp and juice to less bitter substances prunin and naringenin, are 50° C, pH 3.1, enzyme concentrations of 0.05—0.01 per cent and incubation periods of 1-4 hours. Enzyme action at a low temperature, 4° C for 44 hours, hydrolysed naringin to less bitter prunin without a corresponding decrease in Davis test value. Enzymatic hydrolysis of coloured grapefruit pulp (.025 per cent enzyme, 50° C, 1½ hours) reduced bitterness and enabled the pulp to be used for colour fortification of poorly coloured, late season juice. Prior inactivation of pectinesterase naturally present in juice before naringinase treatment is necessary to retain natural cloud.

Freestone peaches. I. Effect of sucrose, citric acid and corn syrup on consumer acceptance, by Pangborn, R. M., *et al.*, *Food Technol.*, 1959, 13 (8), 444.—The type and concentration of sweetener used in canned fruit not only influences flavour but also texture, and in some instances, colour. Granulated and liquid sugars of various types, compositions and combinations are used by the canning industry. Replacement of part of the sucrose by corn syrup solids is

now an established practice with some canners. Its use is recognised in the existing standards of quality and identity. Canned freestone peaches varying in sucrose content (81.46 to 31.40° cut-out Brix), acidity (0.3 or 0.4 per cent) or sucrose replacement with corn syrup at levels of 20, 30, 40, 50, or 60 per cent were evaluated, in this experiment, by 3,043 consumers for flavour and texture quality. Optimum sweetness in the all-sucrose pack was found to be approximately 22.5° Brix. Acidification did not improve flavour. Texture preferences resembled flavour preferences. At an in-going syrup of 40° Brix, the all-sucrose control received significantly higher consumer preferences than did the corn-syrup containing samples. However, at 50° Brix, the samples received equal consumer acceptance. The trained laboratory tasters indicated a significant decrease in fruit flavour and an increase in off-flavour with increasing replacement by corn syrup at the 40° Brix level. Excessive sweetness in the 50° Brix series masked flavour differences at the lower replacement levels. In general, firmness of the fruit increased with increasing corn syrup content.

FUNGICIDES

Generation of ammonia for in-package fumigation of food-stuffs, by Gunther, F. A., *et al.*, *J. agric. Fd. Chem.*, 1959, 7 (7), 489.—Ammonia gas is fungicidal to some common mold organisms, but bulk fumigation with this gas may not afford the long-term protection sometimes required under commercial conditions. In-package generators of ammonia have been developed to maintain critical gas concentrations surrounding a fresh commodity over controlled periods, activated by the highly humid environment within a package of actively respiring plant parts. Two types of practical generators are discussed, with applications to citrus fruit handling. The first

involves simple hydrolysis of diammonium succinate; the other utilizes the moisture-initiated reaction between dry ammonium sulfate and dry soda ash.

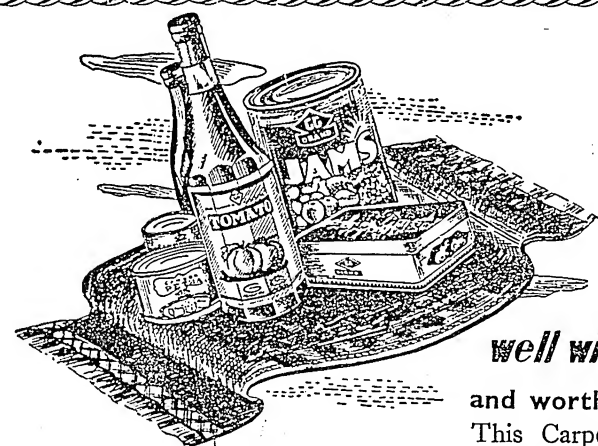
Sorption of ammonia by fruits, vegetables, eggs and fiberboard in dynamic systems, by Gunther, F. A., *et al.*, *J. agric. Fd. Chem.*, 1959, 7 (7), 496.—The comparative rates of sorption and desorption of ammonia gas surrounding 23 kinds of fruits, vegetables, and eggs have been evaluated in a dynamic system with a spectrophotometric technique supplemented by direct chemical assay. Ambient ammonia con-

centrations ranged from about 50 to 700 p.p.m. in air. Sorption rates varied from about 1 to about 150 p.p.m. per hour. The 'buffer' capacity of fiberboard for ammonia has been demonstrated.

INSECTICIDES

The response of *Tenebroides mauritanicus* (L.) and *Tenebrio molitor* L. to methyl bromide at reduced pressures, by Monro, H. A. U. *J. Sci. Fd. Agric.*, 1959, 10 (7), 366.—The response of larvae and adults of *Tenebroides mauritanicus* (L.) to methyl bromide at reduced pressure is complex. Four

zones of differing susceptibility were found: (1) at 15-30 mm. Hg. pressure high mortalities were due more to desiccation than the action of the fumigant; (2) at 30-50 mm. low mortalities coincided with loss of visible activity; (3) at 50-175 mm. increased activity and high mortalities occurred; (4) from 175 mm. to atmospheric pressure activity was normal and mortalities declined. In zones (2) to (4) the responses were independent of humidity. Larvae of *Tenebrio molitor* L. gave responses similar to those in zones (2), (3) and (4) but at different pressure ranges.



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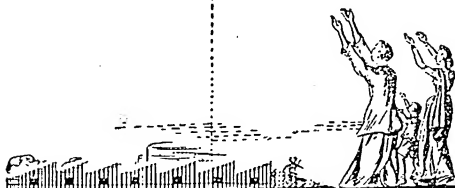
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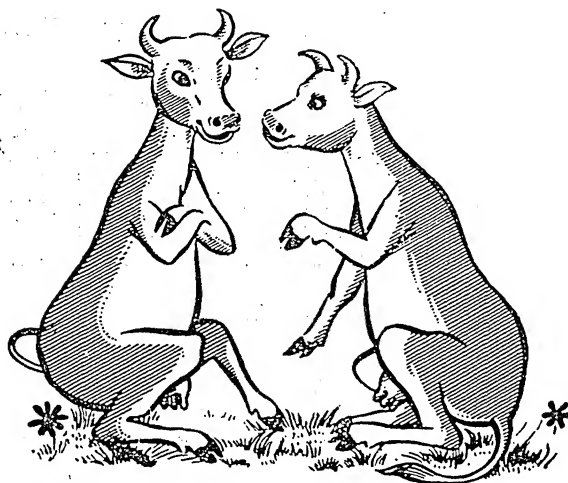
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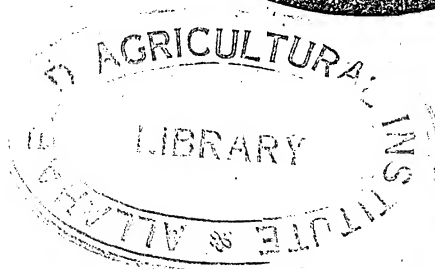
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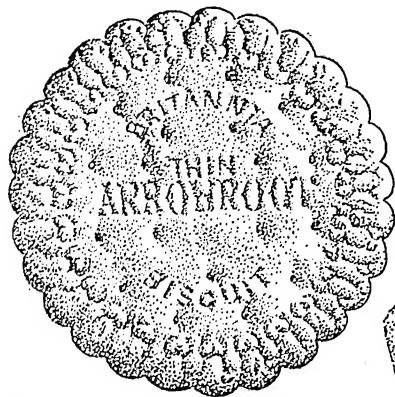
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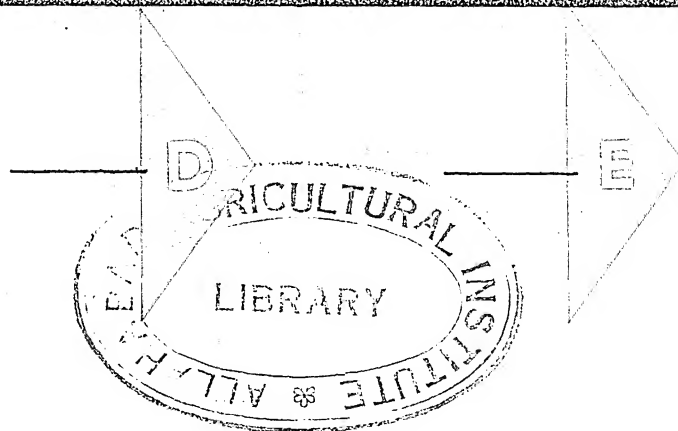
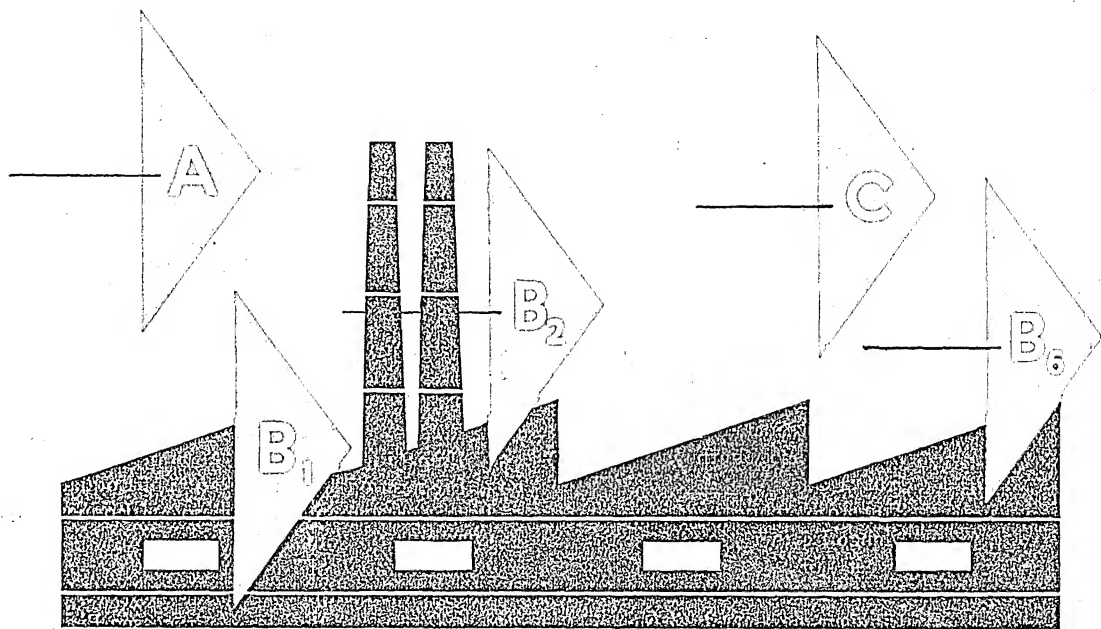
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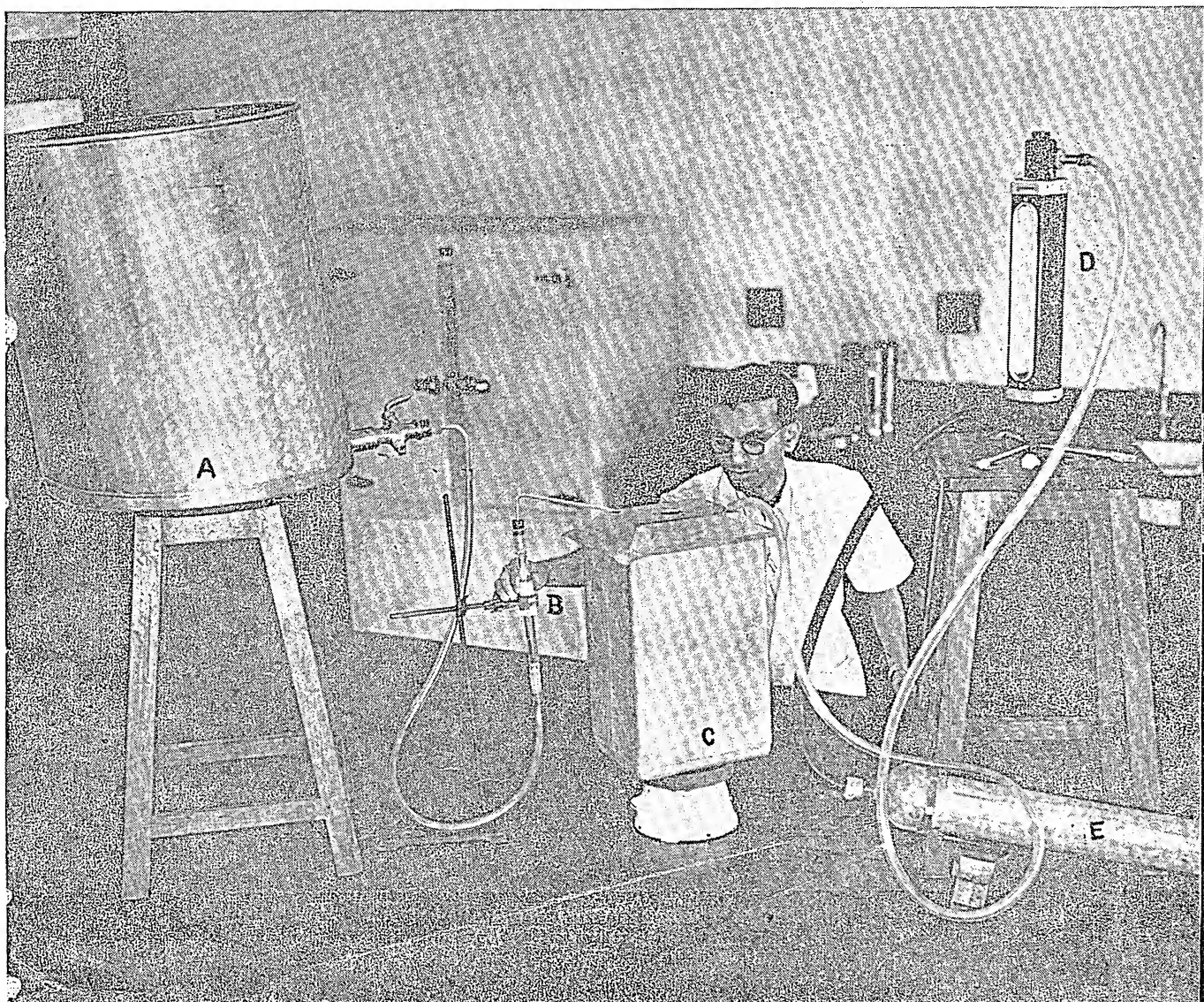
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A METHOD FOR THE QUANTITATIVE ESTIMATION OF ROASTED DATE AND TAMARIND IN COFFEE POWDER *

By C. P. NATARAJAN, R. BALAKRISHNAN NAIR, N. GOPALAKRISHNA RAO,

C. S. VIRAKTAMATH AND D. S. BHATIA

(Central Food Technological Research Institute, Mysore)

Roasted date seed and tamarind are common adulterants in coffee. A qualitative method for detecting the presence of roasted date and tamarind seed powders in coffee powder was reported from this laboratory¹. Further work on the characterisation of the constituent responsible for giving pink or red coloured streaks with alkali in the case of tamarind and date seed by chromatographic method confirmed the presence of cyanidin. A method based on the measurement of this colour is reported here.

Materials and method

Samples of date seeds (*P. dactylifera*) and tamarind seeds were collected and roasted to different degree in an electrically operated sample roaster and powdered. Samples of green coffee were also roasted in a similar manner and blends of the two powders were made with varying content of the adulterant from 5-50 per cent.

After repeated trials the following procedure was standardized: 0.5 g. of the powder was refluxed in a water bath with 100 c.c. of absolute alcohol containing 1 c.c. of concentrated HCl for 30 minutes in the case of date blends and 2 hours in the case of tamarind. After cooling the solution was filtered and made up to volume. Satisfactory colour readings were obtained by diluting this extract 2.5 times in the case of date blends and five times in the case of tamarind. The per cent transmission was obtained using 420 and 490 filters in a Lumetron Photoelectric Calorimeter. The ratio of the optical densities at 420 m μ and 490 m μ was calculated. This ratio (D_{420}/D_{490}) was found to be proportional to the per cent of adulterant in the blend. The variations like different roasting conditions, time of refluxing, stability of colour, etc., were all studied in detail.

The influence of roasting (Table I), time of extraction (Table IV), stability of colour in acidified alcohol (Table III), effect of blending with different roasts of coffee and of the two adulterants (Table II) are shown in various tables. Changes in the ratio of transmission at 420 m μ and 490 m μ in coffee adulterant blends are given in Table V. The applicability of the standard curve was tested separately by asking number of workers to report on the values obtained giving them blend samples. The results are shown in Table VI.

Identification of the colour

Pure samples of date seed and tamarind were hydrolysed by acidified alcohol (2N for 30 min.) and after concentration, spots were made on a Whatman No. 1 circular filter paper. The solvent used was a mixture of water, acetic acid and concentrated HCl (10:30:3)². Known spots of cyanidin was also run side by side. The presence of cyanidin was confirmed by the R_f values in comparison with known cyanidin,

FOOD SCIENCE

FEBRUARY 1960

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* Presented at the symposium on Food Chemistry and Analyses, Calcutta, February, 1960.

TABLE I. *Variations in the ratio D_{420}/D_{490} with different roasts*

Coffee		Date		Tamarind	
Y* (Colour)	$\frac{D_{420}}{D_{490}}$ (1/500 dilution)	Y (Colour)	$\frac{D_{420}}{D_{490}}$ (1/500 dilution)	Y (Colour)	$\frac{D_{420}}{D_{490}}$ (1/1000 dilution)
6.4	2.27	6	0.78	6.8	0.99
5.6	2.21	5.1	0.81	5.2	1.07
5.0	2.19	4.7	0.82	4.2	1.19
4.6	2.15	3.9	0.83	...	...
4.0	2.18	...	...	...	...

* Y = % reflection in Photovolt Reflection meter with tristimulus green filter.

TABLE II. *Effect of blending different roasts of coffee and adulterants on the ratio D_{420}/D_{490}*

Coffee-date blends					Coffee-tamarind blends			
No.	Y Coffee	Y Date	$\frac{D_{420}}{D_{490}}$ 10%	$\frac{D_{420}}{D_{490}}$ 20%	Y Coffee	Y Tamarind	$\frac{D_{420}}{D_{490}}$ 10%	$\frac{D_{420}}{D_{490}}$ 20%
1	6.4	6.0	1.85	1.68	6.2	6.2	1.77	1.45
2	5.6	5.1	1.85	1.65	5.2	5.2	1.83	1.55
3	4.0	3.0	1.94	1.76	4.0	4.2	1.97	1.66
4	6.4	3.9	1.93	1.73	6.2	4.2	1.98	1.73
5	4.0	6.0	1.94	1.68	4.0	6.8	1.68	1.43

TABLE III. *Stability of colour in alcohol solutions*

			% Transmission			
			Initial reading		After 24 hours	
			420	490	420	490
Coffee	...	...	31	58	30	56
Date	...	...	39	36	38	34
Tamarind	...	...	48	46	48	45

TABLE IV. *Changes in ratio D_{420}/D_{490} with time of hydrolysis*

Time (min.)	Coffee (1/500)	Date (1/500)	Tamarind (1/1000)
15	2.39	0.84	1.28
30	2.18	0.75	1.18
60	2.18	0.75	1.12
90	2.20	0.74	1.02
120	2.18	0.75	0.95
180	2.19	0.75	0.95

TABLE V. *Coffee-date and coffee-tamarind blends—Variations of D_{420}/D_{490} with different percentages of blends*

%Adulteration	Ratio D_{420}/D_{490}	
	Date (1 in 500)	Tamarind (1 in 1000)
0	2.25	2.25
5	2.05	1.91
10	1.87	1.81
15	1.73	1.65
20	1.64	1.57
25	1.55	1.47
30	1.45	1.41
35	1.38	1.30
40	1.31	1.27
45	1.26	1.18
50	1.20	1.13
100	0.80	0.80

D_{420}/D_{490} for pure coffee = 2.22-2.26 (Reference data)

TABLE VI. *Verification with unknown blends*

No.	Coffee-date %Date		Coffee-tamarind %Tamarind	
	From reference data	Actual value	From reference data	Actual value
1	0	0	38	35
2	95.0	100	16.5	15
3	15.0	15.0	0	0
4	40.0	40.0	6.5	7.5
5	7.0	7.5	27.0	25.0
6	24.0	25.0	41.0	40.0

mixed chromatogram and with ultra violet absorption. The acid extract on the addition of alkali gives a blue colour which is characteristic of cyanidins.

Discussion

Degree of roasting in the range commonly met with (between Y=6 to 4) did not vary the ratio D_{420}/D_{490} in the case of different roasts of coffee and the adulterants. This ratio for coffee, date and tamarind were respectively 2.25, 0.8 and 0.8 for the same dilution. The peak for the pink colour extracted from date or tamarind was at 490 m μ and that of pure coffee was at 420 m μ and hence the ratio between the transmission at 420 m μ and 490 m μ was taken to represent more precisely the changes in colour due to the

adulterants. The blending of coffee of different roasts with different roasts of date and tamarind seeds did not affect this ratio. Acidified water extraction did not give concordant results but acidified alcohol gave reproducible results. The anthocyanidin colour is very stable in acidified alcohol as shown by the results in Table III. It was also observed that there is no change in the transmission after 30 minutes hydrolysis in the case of date seed and 2 hours in the case of tamarind. Tamarind contains more of the colour principle as compared to date seed. The compounds responsible for the colour exist mostly as a leucobase and on acid hydrolysis the colour is released and it is also interesting to note that the temperature of roasting does not destroy these cyanidin constituents completely. With the method suggested it is possible to estimate definitely adulteration beyond 10 per cent. With roasted date seed and tamarind standard curves could be made with the data in Table V or the values could be interpolated to estimate the per cent of the adulterant.

The possible influence of other admixtures with coffee along with date and tamarind or a combination of date and tamarind, however, needs further study.

Summary

1. The presence of cyanidins in acid extracts of roasted date seed and tamarind seed is confirmed.
2. A method for quantitative estimation of roasted date seed or tamarind seed powders in coffee blends based on the estimation of the cyanidin colours obtained by acidified alcohol hydrolysis has been found to be satisfactory.

Acknowledgement

The authors wish to thank Dr V. Subrahmanyan for his kind interest in this work as well as the Coffee Board under whose auspices this work was carried out.

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EFFECT OF PARTIAL REPLACEMENT OF RICE IN POOR RICE DIET BY POTATO ON THE NUTRITIVE VALUE OF THE DIETS

Roots and tubers have been used as food by mankind from very early times. They are next in importance to cereals, as sources of energy in the diets of people in several countries, notably in Ireland, Western Germany, France and Brazil¹. The most important foods belonging to this category are potato, sweet potato and tapioca. Their importance lies in the fact that they yield about 2-3 times as much calories per acre as common cereals and can be grown both as a kitchen garden crop and on a field scale. The present production and consumption of roots and tubers in India is only 1.2 ounces per day per person¹. In view of the shortage in the supply of cereals, it is possible to make up the same by increasing the production and consumption of roots and tubers. In an earlier publication² studies on the effect of partial replacement of cereals in poor vegetarian diet by tapioca and sweet potato flours on the nutritive value of the diets were reported. The results showed that substitution of rice,

wheat or *ragi* by tapioca or sweet potato flours to the extent of 25 per cent in a poor vegetarian diet did not lead to any deterioration in the overall growth promoting value of the diets.

Potato contains a higher amount of nitrogen than either tapioca or sweet potato. It was therefore considered of interest to study the effect of partial replacement of rice by potato on the nutritive value of the rice diet. Hindhede³ carried out metabolism studies on humans fed diets containing potato as the only source of nitrogen. His results showed that nitrogen equilibrium was maintained in the subjects even when the amounts ingested provided only 4-8 g. nitrogen daily. McCollum *et al.*^{4,5} and Hartwell⁶ reported that the proteins of potato did not support good growth in young animals. On the other hand, Chick and Slack⁷ observed that the proteins of potato promoted good growth in young albino rats. They reported a protein efficiency ratio of 1.8 for potato proteins at 10 per cent level of protein

intake. In the present investigation, the effect of partial or complete replacement of rice in poor rice diet by potato or potato flour on the nutritive value of the diets has been studied.

The potato flour used in this investigation was prepared as follows: Good quality potatoes were obtained from the local market. The skin was removed in a potato peeling machine. The peeled potatoes were washed with water containing 0.02 per cent sodium bisulphite and blanched by steaming for 5 minutes to destroy the enzyme tyrosinase present in the raw potato. They were then sliced and dried in a truck drier in a current of hot air at a temperature of 45-50°C. The dried chips were powdered in a flour mill. The potato flour was analysed for the different constituents according to the methods of A.O.A.C.⁸ Thiamine was estimated according to the method of Swaminathan⁹. The results are given in Table I. The results show that potato flour is

far richer in protein than either tapioca or sweet potato flours.

The effect of replacing 25 per cent rice in a poor rice diet by cooked potato or potato flour on the nutritive value of the diet was determined by the rat growth method. The experiment was carried out in two series. In each series, three groups of freshly weaned, young albino rats (12 in each group, distributed equally according to sex, litter and body weight) were fed on (1) poor vegetarian rice diet (2) the same diet in which 25 per cent of rice was replaced by potato flour or cooked potato and (3) the same diet in which rice was completely replaced by cooked potato or potato flour. The composition of the diet is given under Table II. The feeding was carried out for a period of 8 weeks. Records of daily food intake and weekly increase in body weight of the animals were maintained. The results are given in Table II.

The results on statistical analysis showed that partial substitution of rice by potato flour or cooked potato resulted in a better growth promoting value of the diet when fed to rats. The average weekly increase in weight of rats fed on diets in which 25 per cent of rice is replaced by cooked fresh potato or potato flour was significantly higher than that observed in the case of rats fed on rice diet. The rats fed on diets containing cooked potato or potato flour did not grow well, the average weekly increase in weight being 1.5-2.5 g.

Further studies on the protein efficiency ratio of the proteins of potato are in progress.

TABLE I. *Chemical composition of potato, tapioca and sweet potato flours*

Constituent	Potato flour	Tapioca flour	Sweet potato flour
Moisture %	6.9	9.0	8.3
Protein (N×6.25) %	9.2	1.7	1.6
Fat %	0.4	0.5	0.9
Fibre %	1.6	1.9	2.5
Ash %	3.7	1.4	3.5
Carbohydrate (bydiff.) %	78.2	85.5	83.2
Calorific value	353	353	346
Calcium %	0.02	0.06	0.11
Phosphorus %	0.12	0.08	0.13
Thiamine (mg) %	0.35	0.12	0.15
Nicotinic acid (mg) %	3.2	1.8	2.8

TABLE II. *Average weekly increase in body weight of rats on poor vegetarian diets based on rice and potato*

Diet	Initial weight of rats (g)	Daily food intake (dry weight) (g)	Average gain in weight per week (g)	Test of significance
A. Rice diet*	49.3	7.8	4.45	A ~ B Sig. at 5%
B. Rice+potato flour@	49.3	8.2	5.41	A ~ C " " 0.1%
C. Potato flour*	49.2	6.2	1.50	B ~ C " " 0.1%
D. Rice diet*	45.9	8.7	5.07	D ~ E " " 0.1%
E. Rice+potato flour@	45.8	8.5	6.45	D ~ F " " 0.1%
F. Mashed potato*	45.7	6.5	2.24	E ~ F " " 0.1%

* Rice or potato flour (or equivalent amount of mashed potato), 78.5%; Red gram dhal (*Cajanus cajan*), 5%; Non-leafy vegetables, 8.2%; Leafy vegetables, 2.1%; Skim milk powder, 0.9%; Common salt, 0.3% and groundnut oil, 5%.

@ Rice, 58.9% and potato flour (or equivalent amount of mashed potato), 19.6%; rest of the ingredients are the same as in other diets.

The results obtained in the present experiments have shown that potato can be used as a partial substitute for rice.

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STUDIES ON THE SHELF-LIFE OF PEANUT CANDIES

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Candies are an important component of emergency rations and should have a reasonable shelf-life. Peanut candies have been a subject of study by various investigators. In their studies on the shelf-life of candy, Heaton and Woodroof reported that the effectiveness of the antioxidant, Tenox II, was influenced by the variety of the product treated.

Heaton and Woodroof¹ stored peanut candies at 70°F. Stuckey² used (0.01 per cent) BHA in candies and wrapped them in BHA (0.05 per cent) treated waxed glassine paper. Thus, he could extend the storage life of the candies for 124 days at 76°F. He also used 0.07 per cent Tenox III (14 per cent BHA, 6 per cent PG and 3 per cent citric acid) and could extend the storage life of peanut brittle for 136 days at 76°F.

Cecil and Woodroof³ have used BHA alone and BHA with propyl gallate and citric acid as synergist for increasing the shelf-life of salted peanuts and peanut butter. They found that they could increase the shelf-life of salted nuts up to 133 per cent when the antioxidant was used in both the cooking oil and the salts. By incorporating AMI-72 (containing BHA, citric acid and propyl gallate), Dugan *et al.*⁴ could extend the shelf-life of various nuts by 2.5 to 6.0 times.

The present experiments were undertaken to study the antioxidant property of BHA and BHT, BHA, BHT and shellac and also to study the

fungistatic property of sodium propionate in soft and hard boiled candies.

Experimental

Two types of candies were made. One type was a soft one and the other hard boiled type. They were prepared as follows: The groundnuts were roasted for 25 minutes at 320°F. and the cuticle was detached by scrubbing. For the soft type, sugar and water were added in the ratio of 7:1 and heated to 240°F. and the nuts were added just before the finishing point. The ratio between sugar to nuts was 16:6. For the hard boiled candies, sugar and liquid glucose were added in the ratio of 4:1. The same ratio was kept between the sugar and nuts as in soft boiled candies. The sugar syrup was brought to a temperature of 310°F. and the nuts were added at this point. When cooled it was cut into rectangular pieces. The pieces were wrapped individually in aluminium foil and sealed in 200 gauge polyethylene bags which were finally sealed in tins. This was the control sample. The nuts and the candies were subjected to different treatments: (1) In one lot the nuts were sprayed with an alcoholic solution to give an effective concentration of 0.01 per cent of BHA and 0.01 per cent BHT on the basis of fat. The nuts so treated were dried under a current of hot air. (2) In another lot one per cent shellac was

TABLE Ia. *Soft boiled candies without treatment with sodium propionate*

Period of storage	Chemical constant	Without sodium propionate					
		R.T.			37°C.		
		Control	BHA and BHT	BHA, BHT and shellac	Control	BHA and BHT	BHA, BHT and shellac
30 days 	P.V.	3.45	2.0	3.0	4.3	2.48	2.90
	F.F.A.	1.75	0.76	0.87	1.0	1.19	0.75
	Organoleptic quality	Good	Good	Good	Good	Good	Good
50 days 	W e n t m o u l d y						

TABLE Ib. *Soft boiled candies with the treatment of sodium propionate at room temperature*

Period of storage	Chemical constants	Control	BHA and BHT	BHA, BHT and shellac
75 days 	P.V.	10.87	9.89	10.21
	F.F.A.	0.68	0.51	0.49
	Organoleptic quality	Acceptable; no rancid flavour	Acceptable	Acceptable
130 days 	P.V.	13.77	8.46	11.09
	F.F.A.	0.54	0.28	0.37
	Organoleptic quality	Acceptable; no	rancid flavour	
150 days 	P.V.	2.53	1.89	2.26
	F.F.A.	0.66	0.57	0.49
	Organoleptic quality	Acceptable; no	rancid flavour	
170 days 	P.V.	1.72	2.09	1.67
	F.F.A.	0.79	0.39	0.74
	Organoleptic quality	Acceptable; no	rancid flavour	

used with the above antioxidants and when sprayed gave 0.1 per cent shellac-coating on the nuts. (3) The candies obtained from the control and the two treatments were dipped in 85 per cent alcoholic solution of sodium propionate; thus the candies got a coating of 0.2 per cent of sodium propionate.

One lot of each kind, *i.e.*, control, candies treated (1) with BHA and BHT, (2) with BHA, BHT and shellac, and (3) sodium propionate-coated candies was kept at room temperature (20-25°C.) and another lot in an incubator at 37°C. (100°F.). Periodically the samples were examined for organoleptic evaluation, peroxide value and free fatty acids (F.F.A.). The peroxide values were determined by the method of Lea⁵.

Results and Discussion

The soft boiled candies, untreated with sodium propionate showed specks of mould after 50 days of storage at room temperature, but those treated with sodium propionate did not show any mould growth even after a period of 170 days. These candies showed however increase in the peroxide and F.F.A. values; the moisture content was 7.5 per cent. But the candies were not rancid as shown by organoleptic test. The results are given in Tables I (a) and I (b). The candies that were dipped in sodium propionate developed off-flavour, but they were acceptable.

The hard boiled candies had an initial moisture content of 1.5 per cent. The peroxide values

TABLE II. *Hard boiled candies—Periodical examination for organoleptic quality*, peroxide value† and free fatty acids‡*

Period of storage (days)	Chemical constants	Control	Room temperature		37°C.		
			BHA and BHT	BHA BHT and shellac	Control	BHA and BHT	BHA BHT and shellac
30 ...	P.V.	3.26	2.33	1.36	3.55	2.77	2.72
	F.F.A.	0.22	0.30	0.25	0.25	0.22	0.20
50 ...	Organoleptic:	Good	Good	Good	Good	Good	Good
	P.V.	...	9.97	7.59	8.72	7.59	7.46
70 ...	F.F.A.	...	...	...	...	...	...
	Organoleptic:	Acceptable	Good	Good	Rancid	Good	Good
90 ...	P.V.	11.50	9.87	11.04	10.40	8.37	9.22
	F.F.A.	0.29	0.26	0.22	0.17	0.25	0.23
100 ...	Organoleptic:	Acceptable	Acceptable	Acceptable	Rancid	Acceptable	Acceptable
	P.V.	15.05	9.69	7.42	...	12.13	13.02
130 ...	F.F.A.	0.170	0.245	0.230	0.25	0.23	0.15
	Organoleptic:	Acceptable	Acceptable	Acceptable	Rancid	Acceptable	Acceptable
150 ...	P.V.	9.5	10.25	14.85	13.61	10.42	11.19
	F.F.A.	0.17	0.245	0.23	0.25	0.23	0.15
170 ...	Organoleptic:	Acceptable	Acceptable	Good	Rancid	Acceptable	Acceptable
	P.V.	6.10	7.62	10.57	6.63	8.17	8.80
...	F.F.A.	0.09	0.07	0.19	0.144	0.07	0.107
	Organoleptic:	Acceptable	Acceptable	Good	Rancid	Acceptable	Acceptable
...	P.V.	1.546	1.30	1.74	1.47	1.56	1.52
	F.F.A.	0.16	0.16	0.08	0.16	0.16	0.13
...	Organoleptic:	Good	Good	Good	Rancid	Acceptable	Acceptable
	P.V.	2.19	1.20	1.70	1.78	1.62	2.44
...	F.F.A.	0.19	0.14	0.11	0.22	0.09	0.62
	Organoleptic:	Slightly rancid	Good	Good	Rancid	Good	Good

* Organoleptic evaluation was made by a panel of 4 judges. Opinions were unanimous.

† Expressed as milli-equivalents of peroxide per kg. of fat, the initial P.V. of groundnuts being 1.656.

‡ Free fatty acids expressed as per cent oleic acid.

seemed to rise for a period of 90-110 days and then fell again. As regards F.F.A., it did not rise at all except in one sample treated with shellac solution containing BHA and BHT and stored at 100°F. These candies obtained from nuts treated with antioxidants, and antioxidants and shellac kept well for a period of 170 days at 37°C. (100°F.).

It appears from the results that there is hardly any correlation between rancidity as measured by the peroxide determination and organoleptic evaluation.

Summary and Conclusions

(1) The soft boiled candies (7 per cent moisture) coated with sodium propionate did not develop any significant rancidity over a period of 170 days. There was no mould growth also.

(2) The soft boiled candies (7 per cent moisture), if uncoated with sodium propionate become mouldy even in 50 days.

(3) The hard boiled candies treated with BHA, BHT and shellac have a longer shelf-life than the control.

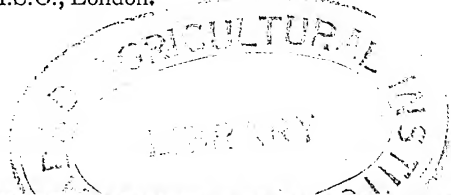
(4) The treated sample is likely to have a minimum storage life of six months at 37°C. and one year at room temperature.

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STUDIES ON THE PREPARATION AND PRESERVATION OF RASAGOLLAS

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Date *et al.*¹ have standardised the method for the preparation of *rasagollas* from cow's milk. This investigation deals with the storage trials of the cow's milk *rasagollas* and the preparation of *rasagollas* from buffalo's milk.

Experimental

The method used for the preparation of cow's milk *rasagollas* is more or less the same as standardised by Date *et al.* except for the fact that commercial sugar was clarified with 125 p.p.m. of SO₂ in addition to milk clarification. The residual SO₂ was evaporated off by boiling the syrup for half an hour. The *rasagollas* were packed in 4 syrup strengths, *viz.*, 45, 50, 55 and 60° B. They were packed in 1 lb. jam cans (301 × 309). The canned *rasagollas* were given 5 minutes processing in boiling water before storing them. These cans were stored at room temperature, 37° C. and 55° C. and analysed after 3 weeks, 3 months and 6 months.

Examination of the canned rasagollas: None of the cans showed any thermophiles, flat sour or other types of bacteria after three weeks' storage at any of the three storage temperatures. However, there were stray aerobic, bacilli which did not cause spoilage. All the *rasagollas* at 55° C. turned brown after three weeks' storage. After further six months' storage at room temperature, these *rasagollas* gave a reading of 25 units in photovolt reflection meter against a standard white enamel plate adjusted at 76.5 units. The optical density of the syrup at 420 mμ was 2.5 and the pH 5.74.

After three months' storage it was found that all the cans at 37° C. and room temperature showed good vacuum (2-12"). The head space varied from 2/10th to 4/10th of an inch. After six months' storage, *rasagollas* in all the cans stored at room temperature were white but only 20 per cent of those stored at 37° C. remained so. The rest all got coloured ranging from light cream to brown.

The lid of the cans stored at room temperature did not develop any black spot but violet spots appeared on the lids of most of the cans stored at 37° C. The final strength of the sugar in

different cans varied from 48 to 61° B. All the cans showed good vacuum (5.5-11").

The pH of the syrup varied from 6.12 to 5.58. There was a slightly lower pH in coloured *rasagollas* than that in the white ones, possibly due to the formation of brown precursors.

The percentage of soluble protein in total protein varied according to the colour, *i.e.*, 40.67 to 64.01 per cent at room temperature and 8.47 to 36.87 at 37° C. The more coloured the *rasagollas*, the lesser is the soluble protein. These observations are in agreement with those of Date *et al.*

Varying amounts of residual SO₂ (1.2-54 p.p.m.) were found in almost all the cans. There was no browning in *rasagollas* where the SO₂ content in the final syrup was 8 p.p.m. or more.

Preparation of rasagollas from buffalo's milk: Buffalo's milk contains about 0.21 per cent of calcium while cow's milk has 0.12 per cent. When calcium is present above a certain limit in the milk it renders the *channa* hard and thus unfit for *rasagolla* making. Varying amounts of calcium were added to cow's milk (Table I) and it was found that the more the calcium added, the harder was the *channa*.

TABLE I. Effect of addition of calcium to cow's milk *channa*

No	Treatment	Solubility of protein %	% of calcium in <i>channa</i>	Quality of <i>rasagollas</i>
1	Control ...	72.0	0.71	Very soft.
2	0.05% Calcium ...	66.8	1.22	Harder than 1
3	0.1% Calcium ...	10.6	...	Harder than 2

It is well known that ion exchange resins help in softening the water and so they were tried to reduce the calcium load of the milk, but the *channa* obtained from such treated milk did not come out satisfactorily for *rasagolla* making.

The enzyme, rennin was also tried but no satisfactory results could be obtained.

Chandrasekhara *et al.*² have tried 'Calgon' and sodium citrate for softening buffalo's milk which

they used for the preparation of baby foods. These salts convert some of the insoluble calcium into soluble salts.

Tables II and III describe the effect of addition of various concentrations of calgon and sodium citrate to the milk. It has been found that the addition of 0.2-0.3 per cent sodium citrate as softening agent and storing the hot milk for some time before precipitation helps in producing a very soft *channa* and the *rasagollas* obtained from it are very satisfactory, and can be considered as good as those obtained from cow's milk.

TABLE II. *Effect of addition of calgon to milk*

No.	Treatment	pH of whey	Yield of channa %	Quality
1	Control ...	4.6	11.5	Hard
2	0.15% Calgon ...	4.93	13.8	Hard
3	0.1% Calgon ...	...	16.3	Not soft
4	0.2% Calgon ...	...	23.0	Not soft
5	0.5% Calgon ...	...	...	Not soft

TABLE III. *Effect of addition of sodium citrate to milk*

No.	Treatment	Yield of channa %	Quality of rasagollas (Marks)
1	Control (Cow's milk)	...	Good quality (10)
2	Control (Buffalo's milk)	22.0	Hard (4)
3	0.1% Sodium citrate	20.0	Soft (6)
4	0.2% Sodium citrate	23.0	Soft (8)
5	0.25% Sodium citrate	20.0	Very good (9.5)
6	0.3% Sodium citrate	18.0	Very good (9.0)
7	0.5% Sodium citrate	19.0	Very soft; softer than usual

Discussion

Table I describes the effect of addition of calcium to cow's milk and it is seen that the increase in calcium load makes the *rasagollas*

harder and harder. The same fact is supported by the findings from buffalo's milk described in Table IV. It is clear that the calcium in *channa* is the least when 0.25 per cent and 0.3 per cent sodium citrate is added and from organoleptic tests described in Table III it is found that the *rasagollas* obtained from the milk treated with softening agent as above gave the best results.

TABLE IV. *Effect of addition of softening agents to buffalo's milk*

No.	Treatment	Calcium in whey mg%	Calcium in channa mg%	Total calcium mg%
1	Control	72.0	119.9	192.0
2	0.1% Calgon	73.3	116.0	189.3
3	0.2% Calgon	88.0	104.0	192.0
4	0.1% Sodium citrate	78.7	112.0	190.7
5	0.2% Sodium citrate	90.7	100.0	190.7
6	0.25% Sodium citrate	94.7	96.0	190.6
7	0.3% Sodium citrate	100.0	92.0	192.0

Conclusion

Buffalo's milk with part of its calcium removed by citric acid treatment gives fairly satisfactory *channa* for *rasagolla* preparation.

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EFFECT OF BAKING ON THE STABILITY OF VITAMIN A IN NUTRO BISCUITS

In an earlier publication it has been found that the stability of thiamine depends upon the level of fortification of biscuits¹. The higher the level the greater is the percentage loss. This note deals with the effect of level of fortification and the nature of vitamin A on the stability of vitamin during baking of 'Nutro' biscuits.

Vitamin A is available in the market as an ester of different fatty acids like acetate and palmitate. They are also available in the water-miscible and fat-soluble forms. So it was desired to study the influence of these different esters on the stability of vitamin A during baking.

The biscuits were prepared in the laboratory according to the method described earlier¹. Different levels of the esters of vitamin A were incorporated in the fat (melting point 41°C.) and used for biscuit making. Tenox II at a level of 0.02 per cent of antioxidants in fat was also added in some batches to study the effect of antioxidants on the stability of vitamin A. Water-miscible vitamin A was added to the water used for making the dough.

Moisture was determined by drying to a constant weight in an air-oven at $100 \pm 2^\circ\text{C}$. pH was determined according to the method of McKim and Moss². Vitamin A was estimated by the A.O.A.C. method³ based on the Carr-Price reaction. The results are shown in Table I.

The loss of vitamin A during baking ranges from 13.3 to 17.0 per cent. It has been found that neither the nature nor the level of fortification has any effect on the stability of vitamin A during baking. Tenox II at a level of 0.02 per cent of antioxidants in fat did not give any beneficial results during baking. As reported earlier⁴ the commercial biscuits contained fat from 10 to 30 per cent. The incorporation of fat at different levels within this range also did not affect the stability of vitamin A. Similarly, pH in the range of 6-7 also did not show any effect on the loss of vitamin A during baking.

The authors are grateful to Dr V. Subrahmanyan, for his kind interest in the work. They also wish to thank Messrs F. Hoffman-La-Roche

TABLE I. *Effect of baking on the stability of vitamin A in 'Nutro' biscuits*

Type of vitamin A	Level of fortification I. U./g.	Baking loss %
Vitamin A acetate without antioxidant ...	144.4	16.0
	116.6	13.6
	103.5	16.8
	87.8	14.1
	70.1	13.4
	61.0	14.0
	36.1	16.0
Vitamin A acetate with antioxidant ...	18.1	14.3
	144.4	13.3
	103.5	16.8
	70.1	16.4
	36.1	16.0
Vitamin A palmitate without antioxidant ...	170.4	17.0
	110.6	14.7
	82.8	14.9
	41.4	14.9
Vitamin A palmitate with antioxidant ...	175.0	17.0
	111.6	12.7
	95.6	13.8
	47.8	13.6
Water-miscible vitamin A acetate ...	170.4	14.7
	47.8	13.6

Biscuit thickness = 0.110—0.115"

Baking temperature = 400 °F.

Baking time = 8-10 minutes.

Co., Ltd., Basle, Switzerland, their agents Voltas Limited, Bombay and Messrs Glaxo Laboratories (India) Private Ltd., Bombay for the supply of free samples of vitamin A.

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MINOR OILS—PAPAYA SEED OIL

Properties of oil from the seeds of papaya fruit have been reported by Peckhole¹, H. W. von Loesecke² and C. F. Asenjo³.

A study of the seed oil from *unripe papaya* from India is reported in this note.

Locally grown unripe green papayas were obtained for a study of pectin extraction. The papayas weighed 2-4 kg. each; the recovered seeds were 3.6 per cent of the weight of the fruit. The white immature seeds were separated from the semi-mature black seeds. The seeds contained 85 per cent moisture and were sun-dried for three days, whereby the moisture content decreased to 7.5-10.0 per cent. The seeds were then powdered coarse and extracted with petroleum ether. Oil at the rate of 16.1 and 26.8 per cent was recovered from white and black seeds respectively. The oil was yellow to brown in colour, the black seeds yielding a lighter coloured oil. The fresh oil has a somewhat pleasant smell. The characteristics of the oil are shown in Table I.

The oil is reported² to consist of the glycerides of the following acids: oleic, 76.50; linoleic, 2.13; palmitic, 11.38; stearic, 5.25; and arachidic, 0.31 per cent.

The mixed oil (acid value, 13.1; sap. value, 190.2; iodine value, 69.9; unsap. matter, 1.76 per cent) was distilled in a centrifugal molecular still at 4-8 microns' pressure, over a range of 100-230°C. The characteristics of the fractions are shown in Table II.

REVIEW SECTION

NUTRITIVE VALUE OF RAGI (*Eleusine coracana*) AND RAGI DIETS

By P. P. KURIEN, M. NARAYANA RAO, M. SWAMINATHAN AND V. SUBRAHMANYAN

(Central Food Technological Research Institute, Mysore)

Ragi is a grain of considerable importance in the dietary of millions of people who inhabit the Deccan plateau. It is generally grown as a dry (rain-fed) crop though in certain areas, it is also cultivated as an irrigated crop¹. The grain is also grown in Ceylon and Africa for use as human food.^{2,3}

Ragi, like other millets, can be grown in areas of low rainfall (25-30 inches). Under rain-fed conditions, the average yield of *ragi* per acre ranges

Papaya seed oil	White seed oil	Black seed oil
Sp. gr. at 30°C. ...	0.9149	0.9072
Refractive Index @ 40°C ...	1.4640	1.4615
Acid value ...	23.9	6.1
Saponification value ...	187.9	187.0
Iodine No. (Wijs') ...	73.5	74.7
Unsaponifiable matter% ...	2.7	1.9
Viscosity (Poises) @ 30° C ...	0.231	0.143
Solidification point (°C.) ...	—4	—4

Distillation temp. °C	Fraction Wt. %	Acid value	Iodine value	Sap. value	Unsap. matter %
100	6.5	159.0	67.9	196	1.6
150	2.1	59.0	64.0	133	26.2
200	14.7	1.9	68.1	184	5.3
230	43.0	0.7	70.5	193	0.9

The oil may be utilised for industrial and edible purposes.

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from 500-700 lb. while under irrigated conditions a higher yield of 1500-2500 lb. can be obtained¹. *Ragi* has the unique advantage over *jowar* (*Sorghum vulgare*) or *bajra* (*Pennisetum typhoideum*) in that it is not easily attacked by insects during storage. The production of *ragi* in India during 1955-56 was about 1.8 million tons, more than 80 per cent of this production being confined to the states of Madras, Mysore, Andhra and Bombay.

TABLE I. Chemical composition of different varieties of ragi (*Eleusine coracana*)

Variety	Colour	Moisture %	Ash %	Crude fibre %	Crude protein % (N × 6.25)	Fat % (Ether extractives)	Carbo-hydrates % (by diff.)	Calcium mg. %	Phos-phorus mg. %	Iron mg. %	Thiamine µg/100g
RO 862 ...	Brown	12.5	2.17	3.3	9.00	1.34	71.69	370	215	5.5	520
RO 870 ...	Brown	12.3	1.68	2.9	9.49	1.24	72.39	380	200	5.8	540
RO 871 ...	Brown	12.5	1.93	3.0	8.67	1.23	72.67	368	210	5.6	500
RO 883 ...	Brown	13.0	2.46	3.1	8.90	1.25	71.29	354	205	5.5	530
K ₁ ...	Brown	13.1	1.58	3.4	7.12	1.42	73.38	311	252	5.2	520
R CO ₂ ...	Light brown	13.3	1.74	2.8	8.40	1.42	72.34	261	229	5.1	550
EC 4310 ...	White	13.0	2.60	3.2	10.58	1.65	68.97	278	322	6.0	585
Majjige ragi ...	White	13.1	2.80	3.2	7.73	1.62	71.55	430	285	5.9	575

Chemical composition of Ragi

Unlike all other common cereals, the grain is an utricle and has a hard seed coat which is difficult to be separated by mechanical means. The grains are very small having a diameter of only 1-1.5 mm. and vary in colour from dark brown to nearly white, depending on the variety. The chemical composition of different varieties of ragi have been studied by different groups of workers^{4,5}. The results (Table I) have shown that there is a fairly wide variation in the chemical composition due to variety. It is evident from the results that ragi is a very rich source of calcium. It is also a fairly good source of some B-complex vitamins.

Proteins: Kadkol *et al.*⁴ analysed different varieties of ragi and reported values ranging from 7.1 to 10.6 per cent for the protein content. This variation in the protein content of ragi may be attributed to variety or soil and locality in which they were cultivated. Niyogi *et al.*⁶ studied the distribution of proteins in ragi by extraction with different protein solvents. They found sodium chloride solution (4 per cent), 70 per cent hot alcohol and dilute sodium hydroxide, when used successively, extracted about 20 per cent, 18 per cent and 22 per cent respectively of the total nitrogen of ragi. About 40 per cent of the total nitrogen in ragi could not be extracted even by dilute sodium hydroxide. The same workers isolated and analysed *eleusin*, the alcohol-soluble protein of ragi, the presence of which was earlier reported by Narayana and Norris⁷. The amino acid composition of the proteins of ragi was studied by several workers, both by chemical and

microbiological assay methods⁸⁻¹¹. The essential amino acid make up of the proteins of different varieties of ragi is given in Table II. These figures indicate that ragi proteins are good sources of all the essential amino acids except lysine. As in the case of other cereal proteins, lysine is the limiting amino acid in ragi proteins also.

TABLE II. Amino acid composition of different varieties of ragi (*Eleusine coracana*)
(Values expressed for 16.0 g nitrogen)

Amino acid	Co 1†	Co 12†	(Bazaar variety)†	Ceylon
Arginine ...	5.32	6.80	3.56	...
Histidine ...	1.50	1.40	1.50	...
Lysine ...	3.30	3.40	3.50	3.1
Tryptophan ...	1.65	1.46	1.56	1.1
Phenylalanine ...	5.20	4.90	3.0	2.7
Methionine ...	3.50	2.60	3.0	1.9
Threonine ...	3.10	4.30	3.03	2.9
Leucine ...	9.49	10.46	8.54	5.9
Iso-leucine ...	6.17	6.70	6.41	3.1
Valine ...	6.86	7.43	5.77	6.3

† Indian

Carbohydrates: Ragi contains about 69-73 per cent of carbohydrates of which poly-saccharides including starch form the main constituent. Subrahmanyam *et al.*¹² reported that the sample of ragi used in their experiments contained 66.2 per cent of starch and 1.2 per cent of reducing sugars. Hemicelluloses, celluloses and other carbohydrates accounted for 6.8 per cent of the grain. Ragi starch belongs to the group of low viscosity starches and its viscosity is further lowered by bleaching¹³.

TABLE III. *Protein, calcium and phosphorus contents of the husk and endosperm of ragi*

Component	Component as % of whole grain	Protein (N \times 6.25)		Calcium		Phosphorus	
		%	as % of protein in the whole grain	mg/100g	as % of calcium in the whole grain	mg./100g.	as % of phosphorus in the whole grain
Whole grain ...	...	7.0	...	345	...	237	...
Husk ...	13.4	14.8	28	1,254	49	246	14
Endosperm (after discarding the supernatant) ...	81.3	3.2	37	58	14	84	30
Dried solids from supernatant ...	5.7	45.5	37	2,234	36	2,438	58

Minerals: The mineral content of *ragi* is reported to vary with the variety and soil in which it is cultivated. Kadkol *et al.*⁴ reported that the mineral content of *ragi* ranged from 1.58 to 2.80 per cent. *Ragi is unique among the cereals in being a very rich source of calcium, containing about 0.33 per cent as compared to 0.01-0.06 per cent present in other common cereals.* In eight different samples of *ragi* which Kadkol *et al.*⁴ analysed, the calcium content varied from 0.26 to 0.43 per cent. Kurien *et al.*¹⁴ showed that about 50 per cent of the calcium present in the whole grain is associated with the outer husk and is not released by acid treatment.

The phosphorus content of *ragi* is comparable with that of other cereals. Kadkol *et al.*⁴ reported that the phosphorus content in different samples of *ragi* varied from 0.2 to 0.32 per cent. Sundararajan⁵ and Giri¹⁵ reported that about 80 per cent of the total phosphorus in *ragi* is present in the form of phytin phosphorus. Immature seeds of *ragi* were reported to contain a lower amount of phytin phosphorus than the mature seeds. Iron content of *ragi* varies from 5 to 6 mg. per 100 g. *Ragi* is the richest source of iodine among the cereal grains, containing as high as 101 μ g. per kilogram. The presence of sulphur to the extent of 0.2 per cent and zinc to the extent of 0.002 per cent in *ragi* was also reported.

Vitamins: Chemical assay of the B-complex vitamins in *ragi* has shown that it contains 0.5–0.6 mg. of thiamine and 1.1 mg. of nicotinic

acid per 100 g. The amount of riboflavin present in *ragi* is only 0.1 mg. per 100 g. Bhagwat *et al.*¹⁶ postulated the presence of an antithiamine factor in *ragi* and *ragi* extracts as they could not recover a considerable portion of thiamine added to *ragi* and *ragi* extracts. Swaminathan *et al.*¹⁷ later showed that there was no antithiamine factor in *ragi* and the observations of Bhagwat *et al.*¹⁶ could be explained by the fact that the added thiamine is tenaciously retained by *ragi* and is not extracted by the methods adopted by these workers for the chemical assay.

Distribution of Protein, Calcium and Phosphorus in the Husk and Endosperm of Ragi

Kurien *et al.*¹⁴ studied the distribution of protein, calcium and phosphorus in the husk and endosperm of *ragi*. The husk and endosperm of *ragi* were separated by soaking the whole grain in water for 24 hours, grinding and separating the husk on a 100 mesh sieve. The protein, calcium and phosphorus contents of the husk and endosperm of *ragi* are given in Table III. The results show that the husk contains 28 per cent of the total protein, 49 per cent of total calcium and 14 per cent of total phosphorus present in the whole grain. This would explain the poor absorption of calcium and nitrogen from *ragi* observed in the metabolism studies referred to later. Contrary to the popular belief, refined *ragi* flour prepared by wet grinding process has a low nutritive value and is a poor source of protein and calcium.

Digestibility and Biological value of Ragi Proteins

The biological value and digestibility co-efficient of *ragi* proteins at 5 per cent level in rats were found to be 90.5 per cent and 77.5 per cent respectively⁶. Swaminathan¹⁸ reported figures of 89 and 80 for the biological value and digestibility co-efficients of *ragi* proteins in adult rats at 5 per cent level of protein intake. The protein efficiency ratio of *ragi* proteins¹⁹ at 5 per cent level of intake was found to be only 0.71. From the above, it can be concluded that *ragi* proteins at a level of 5 per cent, though efficient for the maintenance of adult rats, are not efficient in supporting growth of young rats. This may be due to the partial deficiency of one or more essential amino acids in *ragi* proteins, which are required for promoting growth in young rats. Swaminathan²⁰ studied the supplementary relations between the proteins of *ragi* and those of pulses and skim milk powder, by the nitrogen balance and rat growth methods. The results showed that *ragi* proteins when supplemented with those of pulses and skim milk powder were slightly superior to those of rice, for the maintenance of nitrogen balance in adult rats. *Ragi* proteins by themselves could not promote good growth in rats, but when supplemented with those of pulses and skim milk powder, were quite efficient in supporting growth in young rats. Parching of *ragi* was found to increase the biological value and lower the digestibility co-efficient of *ragi* proteins to a slight degree²¹.

Availability of Calcium and Phosphorus from Ragi

Ragi is a very rich source of dietary calcium containing as much as 300 mg. per 100 g. The phosphorus content of *ragi* is comparable with that present in other cereals. More than 70 per cent of the total phosphorus in *ragi* is present in the form of phytin phosphorus which is not easily available for animal nutrition¹³. Ranganathan²² studied the utilisation of calcium and phosphorus in rats. He reported that only 42.6 per cent of calcium and 42.4 per cent of phosphorus are retained by the rat. Giri¹³ studied the availability of calcium from *ragi*, *jowar* (*Sorghum vulgare*) and *bajra* (*Pennisetum typhoides*) using albino rats, and reported that at the same level of calcium intake from different

millets, the availability of calcium from the different grains was of the same order.

Nutritive value of Poor vegetarian Diets containing Ragi

The nutritive value of a poor vegetarian diet based on *ragi* has been studied by different workers by growth experiments on rats²³. The results indicate that the growth promoting value of a diet based on *ragi* is higher than that of a rice diet, the average weekly increase in body weight of rats ranging from 6-9 g. on *ragi* diet as compared to 4-6 g. on rice diet. Kurien *et al.*²⁴ studied the effect of partial or complete replacement of rice by *ragi* in poor vegetarian diets on the growth, metabolism, liver composition and serum proteins of rats. The results (Table IV) showed that replacement of rice by *ragi* to the extent of 25 per cent or more resulted in increased growth rate of rats (2½ times the control). Rats fed on rice diets in which rice was partially or completely replaced by *ragi* had a significantly higher content of R.B.C., haemoglobin and serum proteins. The higher growth rate noted in the case of rats fed on rice-*ragi* diets was attributed by the authors to the high calcium content of *ragi*, as poor rice diet is highly deficient in calcium. The results obtained by these workers showed that calcium deficiency in rice diets can be made up by replacing rice by *ragi* to the extent of 25 per cent to 50 per cent.

TABLE IV. Effect of partial or complete replacement of rice by *ragi* in vegetarian diets on the growth and haemoglobin content of rats

(Duration of experiment: 13 weeks)

Percentage of rice and <i>ragi</i> in the diet		Average weekly gain in body weight (g)	Haemoglobin (g./100cc)
Rice	... 78.5	4.06	13.34
Rice	... 58.9	7.98	14.60
Ragi	... 19.6		
Rice	... 39.2	8.70	14.53
Ragi	... 39.3		
Ragi	... 78.5	8.74	14.09

TABLE V. Mean daily intake and balance of nitrogen, calcium and phosphorus in children on rice and ragi diets

Diet No.	Quantity of rice and ragi in the diet (g)		Nitrogen			Calcium		Phosphorus	
			Intake (g.)	Balance (g.)	Apparent digestibility%	Intake (mg.)	Balance (mg.)	Intake (mg.)	Balance (mg.)
A	Rice	... 280	4.408	1.482	70.7	258.5	51.9	463.9	116.8
B	Rice	... 210	4.463	1.186	66.5	470.6	105.8	576.6	165.1
	+ Ragi	... 70							
C	Rice	... 140	4.476	0.888	63.5	692.8	174.9	679.5	125.4
	+ Ragi	... 149							
D	Ragi	... 280	4.510	0.520	53.2	1,151.0	225.8	886.7	135.2

Metabolism studies on Ragi diets in Children and Adult humans

Subrahmanyam *et al.*¹⁰ studied the metabolism of nitrogen, calcium and phosphorus in adult humans fed on a diet based mainly on *ragi*. All the subjects were in positive N, Ca and P balances. The apparent digestibility of the proteins in the diet was only 50 per cent. The low apparent digestibility of the proteins was attributed by the authors to the presence of a large amount of fibre in *ragi*. About 85 per cent of the ingested phytin phosphorus was found to be hydrolysed in the intestines.

Joseph *et al.*²⁵ studied the metabolism of nitrogen, calcium and phosphorus in children fed on poor vegetarian diet based on *ragi*. All the subjects were in positive, N, Ca and P balances. The apparent digestibility of the proteins was only 53 per cent. Joseph *et al.*²⁶ reported that partial or complete replacement of rice by *ragi* in a poor vegetarian diet caused a decrease in the retention of nitrogen and an increase in the retention of calcium in children (Table V). The above authors concluded that replacement of 25 per cent of rice by *ragi* made up the calcium deficiency in the diet and decreased the nitrogen retention only to a slight extent.

Utilisation of Ragi for the Production of Malt and Malt extract

Ragi can be used for the preparation of good quality malt and malt extract. Sastry²⁷ studied

the optimum conditions for the preparation of *ragi* malt. The method recommended by the author consisted in steeping the grain in running water for 24 hours and in couching the grain for germination for 72 hours at temperatures ranging between 23 and 25°C. The germinated grain was then dried, the vegetative portion removed by rubbing, and the resulting grain was powdered. Niyogi *et al.*⁶ reported that the diastatic activity of *ragi* malt was less than that of barley malt.

Chandrasekhara *et al.*²⁸ studied the factors affecting the yield and quality of malt extract from *ragi*. They reported that when *ragi* malt was mashed with an equal amount of gelatinised wheat or *jowar* flour, larger yield of good quality extract was obtained than that obtained when the malt alone was mashed. The malt extract possessed an agreeable flavour and is suitable for the preparation of infant and invalid foods. The project costs for the manufacture of malt extract from *ragi* were worked out by Chandrasekhara *et al.*²⁹. The cost of malt extract (80 per cent solids) has been estimated to be about Re 1 per pound.

Enzymes of Ragi malt

Chandrasekhara and Swaminathan³⁰⁻³³ studied the amylases, proteases, glycono- and pyrophosphatases of germinated and ungerminated *ragi*. Ungerminated *ragi* possessed very little of amylase, protease, and phosphatase activity.

The activities of the above enzymes, however, increased when the grain was germinated.

Use of Ragi malt in the Preparation of Nutritionally balanced Malt foods suitable for Feeding weaned Infants

Chandrasekhara *et al.*³³ standardised the conditions for the preparation of a nutritionally balanced malt food by blending malted *ragi* flour with skim milk powder, low-fat groundnut flour, puffed Bengal gram flour and fortifying with different vitamins and minerals. The malt food was found to be as good as whole milk powder in supporting growth of rats and in supplementing poor rice diet. The malt food was also found to be a good supplement to the diet of weaned children³⁴.

Conclusions

It is evident from the above account that *ragi* is unique among cereals in being a rich source of

calcium. Studies conducted on children have shown that replacement of rice by *ragi* even to the extent of 25 per cent in a poor vegetarian diet helps to overcome the calcium deficiency in the rice diet. Besides, *ragi* is suitable for the preparation of malt and malt extracts and balanced malt food which can be fed to weaned infants and young children. In view of the fact that *ragi* is a rich source of calcium and can be easily grown in different parts of the country, it will be desirable to encourage the production and consumption of *ragi* in increasing amounts by the rice eating population. Such a step will not only help to overcome the rice shortage but also the calcium deficiency in the rice diet. Since *ragi* is not attacked readily by insects during storage, it has the added advantage that it can be easily stored for long periods to meet emergencies of food shortage.

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Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during November—December 1959 are given in this section.

S (IS) 4

Progressive investigations on storage behaviour of citrus fruits by H. C. Srivastava (November 28, 1959).—Introducing the subject the speaker said the origin and history of citrus fruits were not fully known and it was believed that at least two species of *Eucitrus* were indigenous to Assam. But the commercial cultivation of these fruits has been started only in modern times. It is reported that at present 254,641 acres are under citrus cultivation with an annual production of 352,200 tons valuing approximately 176 million rupees. It is estimated that about 30 per cent of this production goes to waste during handling, storage and transportation which amounts a loss of approximately 42 million rupees. In order to avoid the glut and save this heavy spoilage, the optimum conditions and approximate refrigerated storage life of various types of citrus fruits were determined. But even at optimum conditions heavy spoilage was noticed. It was due to the fact that fruit passed its pre-climacteric phase on the tree and therefore was easily vulnerable to fungus infections. In order to prevent the spoilage, a search for a suitable fungicidal treatment was made based on the studies made on LD₅₀ value, effect of spore-load on respiration and spoilage, effect of temperature on incubation, effect of vapours on spore germination etc. It was found that 2 per cent formalin spray in cold storage rooms and keeping the oranges in wooden crates previously treated with 5 per cent lysol solution, reduced the spoilage to 10.37 per cent at the end of 60 days storage of mandarins as against 46 per cent spoilage in the controls. To further improve the

storage life, Prorex-D (a mineral oil) was tried, which resulted in the physiological breakdown of the fruit, but it was found that treatment of upper half, (towards stem end) with the oil reduced the respiration rate and the fruit was in a fresher condition. This treatment, however, did not control the microbial spoilage and therefore a number of treatments including various skin coating, fungicidal wrappers and liners, and polythene bags, were tried. It was found that fruits treated with Z.P. wax emulsion and wrapped in Diphenyl wrappers kept very well for 13 weeks at 42-45° F and 80-85 per cent R.H. A detailed study showed that 30 mgm. of diphenyl is optimum for every 10" square wrapper which would suffice to wrap one orange. It was also found that when such treated fruits were kept in polythene bags (150 gauge) with 12 vents of 4 mm. diameter each for 12 fruits, they remained very fresh and had better post-storage life.

In order to extend the common storage life of the fruit, it was found that by treating the fruits with 4 per cent Z.P. Wax, fruits kept for 24 days with less than 10 per cent over-all spoilage, as against heavy spoilage in untreated fruits within 14 days of storage. Later it was found that treating the fruit with 1 per cent SOPP and Hexamine solution and waxing with 6 per cent wax emulsion (evolved at this Institute) reduced the spoilage still further and kept the fruits in fresh condition for 24 days.

The speaker then described a simple device for special respiration test for fruits. During this study it was observed that the citrus fruits (mandarins and limes) when kept in an airtight container showed at

first a negative pressure, followed by a quick positive pressure. It was also noticed that the number of hours elapsing before the pressure returns to positive and the slope of positive pressure were directly correlated with the cold storage life of the fruits. This finding could be utilized for judging the vitality of the fruits before keeping them for longer storage.

Some of the important points raised during the discussion related to the feasibility of using citric acid and sodium benzoate in the wax emulsion, thickness of the wax film required on the fruit to prolong its life, basis for making 24 vents in polyethylene bags and the size of the vents, use of diphenyl dip treatment for improving the storage life of oranges as practised in other countries, melting point of the waxes, cost of waxing and whether it is applicable on home-scale level, the thickness of wax film depending on the temperature, time of dip, etc.; whether the favourable action of wax was physical or chemical, significance of different percentages of wax in the emulsions and whether repeated dippings in low strength emulsion would not give the same effect as observed with higher strengths, possibility of using oil base instead of water for the emulsion, the method of extracting essential oil from the fruit, how the method compares with other treatments like diphenyl, definition of maturity of the fruit for collection, relative post-storage life after wax treatment as compared to common storage life, the reason for limes and lemons having poor storage life in spite of their high acid content etc.

While answering the questions the speaker said that utmost care is

needed during picking and handling of the fruit as otherwise there would be an adverse effect on storage. Any fungicide with low pH is difficult to incorporate in the wax emulsion as it will affect the stability of the emulsions adversely and sodium benzoate being a weaker fungicide could not control the spoilage particularly when the spore load was high. The thickness of the film of wax coating varies from 4 micron to 15 micron depending on the concentration of wax emulsion. Only a particular concentration of wax emulsion will be optimum for a particular variety of the fruit to check against anaerobiosis. Ammonia and oil cannot be used as both of them cause physiological injury to the fruits.

Winding up the discussion, the President said that the problem of storage of fruits is of great importance and the concept of using wax coatings had come to stay now. It is not merely the maturity of the fruits that counts but the seasonal environments also influence the storage life. He said that work on limes should also be done on the lines of the treatment of oranges, as they are universally used and have high acidity. Some of the common practices prevalent such as storing limes in moist sand could be combined with benefit with the wax treatment. Monsoon crops are highly susceptible to spoilage and have a short life. He felt that some method should be evolved to prolong their storage life as well. The mechanism of wax treatment in improving the life of the fruits needs to be ascertained. It is also worthwhile to study the influence of incorporating certain terpenes at the time of dipping on the keeping quality of the fruit. He concluded by saying that possibility of introducing a completely indigenous composition of wax using sugar cane wax, rice bran wax, etc., should be investigated.

S(IS) 5

Nutrition and cell function,
by A. Sreenivasan (December,

11, 1959).—Spectacular and far-reaching discoveries in the field of nutrition during the last few years have made it possible for supporting growth and well-being in a large number of experimental animals including man. More recent efforts have been directed to intensive studies on cellular phenomena in relation to dietary essentials. In particular, the concept of the dynamic nature of tissue constituents has resulted in the realisation of the importance of differences in tissue response to stress conditions such as those resulting from protein starvation, deficiency of vitamins and other metabolic upsets.

Further knowledge on biochemical events leading to what can be called reversible and irreversible types of cell damage has been accumulating from studies with fragmented cell fractions. The definition of the ultra-structure of the cell and its components, namely, nuclei, mitochondria, microsomes and soluble supernatant, has been followed by characterisation of their functions in general metabolism. The mitochondrion is a giant polymer with repeating units and having the systems responsible for the terminal transport of electrons successively to molecular oxygen residing in the outer membrane, the other oxidative systems being confined to the intra-mitochondrial phase. Conditions of stress generally result in the same effects as that of hypotonicity with consequent swelling and loss of components. There is corresponding change in the properties of the mitochondrial membrane which, in the normal state, is cemented together by an elaborate system of protein structures. When the uncoiling of the convoluted membrane as a result of the stress becomes excessive, there is irreversible loss of oxidative function and impairment in synthetic or regenerative processes.

Evidence is coming forth to correlate nutritional factors with the functioning of the mitochondria and, in particular with the specific

activities of their membranous components. These were discussed with typical examples of nutritional deficiencies.

Some of the important points raised during the discussion related to the nature of protein deficiency leading to liver necrosis, the possibility of bringing back the animal to normalcy even at an acute stage of stress, the structural features of the mitochondria, whether mitochondria were the first to be affected in stress conditions and whether they were more sensitive than other components of the cell, whether nuclear damage could be similarly observed, reduction in mitochondrial population as a result of swelling and breakdown, changes, if any, in the character of mitochondria in a cancerous cell, likelihood of some abnormal mitochondria occurring even in a normal cell, functions of nucleic acids in the cell, the nature of cell duplication during regeneration, antivitamins as stress factors, etc.

Commending the work as an important contribution to fundamental research, the President made some reference to the tremendous amount of development that has taken place during the last few years in this field. He concluded by saying that much more remains to be understood concerning the function of the diverse factors that control metabolic processes in the animal or human organism.

S(IS) 6

Enzymatic synthesis of amylose and amylopectin in rice,
by M. Kantharaj Urs (December, 21, 1959).—The speaker first described the importance of the relative concentrations of these two macromolecular components of starch in relation to the cooking characteristics of rice and said that the rice varieties with low amylose content had poor swelling qualities and also they generally cooked into a pasty mass.

Pointing out that the factors which govern the relative ratios

of these two components are not clearly understood the speaker said that as a first step in this direction the study of the phosphorylative pathway of synthesis of amylose and amylopectin in rice was undertaken.

The enzymes involved in the conversion of glucose to amylopectin, namely, hexokinase, phosphoglucomutase, phosphorylase and Q-enzyme, were found in the extracts, of the mature grain and methods for purification and assay of the enzymes have been worked out.

The speaker pointed out that, unlike in the case of tubers, difficulties were encountered in demonstrating the presence of phosphorylase in rice extract due to the presence of beta-amylase in high concentrations. Separation of beta-amylase was effected by repeated fractional precipitation with ammonium sulphate.

The enzyme required the pre-

sence of a primer like achroic dextrin. The concentration of the primer was found to effect the length of the amylose chain synthesised as judged by intensity of blue colour with iodine. The optimum pH for activity of the enzyme was 6.4 and optimum temperature was 35°C. The thiol group reagents iodoacetate and p-chloromercuribenzoate caused inhibition at a concentration of 5×10^{-3} M.

The speaker then referred to the synthesis of amylopectin from amylose by the action of Q-enzyme. The enzyme activity was measured by following the changes in blue colour with iodine as well as the increase of reducing groups. The optimum pH for enzyme activity was 6.9 and temperature 31°C. When the amylose chain was reduced to the stage of achroic dextrin, the enzyme activity ceased. This indicated that the substrate must have a minimum chain length of 40-50 glucose units.

The discussion that followed the talk brought out points relating to the methods for estimating amylose and amylopectin, mechanism of Q-enzyme action with reference to its apparent dual role of splitting α -1-4 linkages and synthesising α -1-6 linkages, changes occurring during the ripening of rice grain, structural changes during parboiling, influence of additional factors on cooking and milling qualities, use of amylose as adsorbent for separation of Q-enzyme from amylases, etc.

Concluding, the President referred to the complexity of the problem and specially to the difficulties encountered in the study of natural processes under in vitro conditions. He suggested that the mode of action of enzymes at relatively higher concentrations might be investigated and felt that it would be worthwhile investigating new approaches to the problem.

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Oils from soya beans

E (IS) 9

We are much interested in different products of soya bean that may be used in our daily necessities as food. As such, may we request you to help us by furnishing the details of the process of making oil and other products from soya beans? Let us also know the names of firms who are now engaged in this line of work in our country. (Calcutta)

The method of extraction of oil from soya beans is given below:

Soya beans do not require decortication for the extraction of oil except when the soya meal is meant

for human consumption. Sound beans are allowed to flow through cleaners which may be a simple scalping shoe or a more complex type of cleaner using a combination of multiple screening and aspiration. From the cleaners, the beans flow to the cracking rolls provided with corrugations. The cracked soya beans (particle size approximately 1/8th of the whole bean) are dried to a moisture content of about 2½-3 per cent. The dried bean particles are passed through conditioners in order to temper them such that the temperature of the cracked beans before entering the screw press (expeller) is about 270-280°F.

In the continuous press, immediate crushing or shearing action is effected. The pressure inside the press increases until the crushing action of the heavy screws breaks the cell structure and forces the oil to drain out. The oil flows from the press over a vibrating screen and then through a filter press to clarify it by removing particles of meal and foots. It is then pumped to storage tanks. The crude oil is thereafter refined by the alkali refining method and finally bleached. The oil content of the resultant meal varies from 5-8 per cent. About 22-25 tons of soya beans can be processed per day with continuous

screw presses. The steam consumption per ton of soya beans varies from 550 to 900 lb., power consumption from 80 to 100 kw. and the yield of crude oil is approximately 320 lb. per ton.

Soya bean oil can also be obtained by solvent extraction of the beans using petroleum hydrocarbons (n-hexane) as a solvent. In order to solvent-extract beans, the cracked soya beans are flaked in flaking rolls before extraction. The fragile flakes are then fed into extractors with the solvent for separation of the oil. The meal flakes and the oil are desolventized in special equipment designed for the purpose. The oil is degummed or alkali-refined for use in edible and drying oil products.

The methods of preparation of soya bean milk and pre-digested form of protein food called soya sauce are given in the enclosures. Other soya bean foods which are being traditionally prepared and are popular in the Far Eastern countries like Japan and China include *tofu* or soya bean curd made by precipitating the protein from soya bean milk, *miso* a fermented mixture of soya bean and rice or barley, and *natto*, a fermented product similar to cheese.

We, however, wish to state that none of the above products is being prepared in our country at present. The only product that is now available on the market is 'Bovite' which is a soya sauce concentrate developed at this Institute and now being manufactured by Messrs F. K. Research Products, Post Box No. 56, Mysore. The following books, *vis.*, 'Soya bean and soya bean products', Vols. I and II, by K. S. Markley, published by the Interscience Publishers Inc., New York, deal exhaustively on the subject.

Condensed milk

E (IS) 10

We want information from you on the plant and equipment and their availability for the manufacture of condensed milk on a small scale as well as on large scale. (Meerut District)

Condensed milk cannot be prepared on small scale or cottage scale as it requires special type of equipment and needs heavy investment. Regarding details about availability of equipment and their cost, you may kindly contact some of the following engineering firms:

- (1) Messrs Larsen & Toubro Ltd., I.C. House, Dougall Road, Ballard Estate, P.O. Box No. 278, Bombay 1.
- (2) Messrs Mather & Platt, Ltd., Engineers, Hamilton House, 8, Graham Road, Ballard Estate, P.B. No. 327, Bombay 1.
- (3) Messrs A.P.V. Engineering Co., Ltd., Post Box No. 2492, Calcutta.

As regards the packing of the finished product, it is generally packed in hermetically sealed tin containers.

Spoilage of pickles

E (IS) 11

Most of the pickles that we make at home with mangoes and lemons get deteriorated after some time. I request you to advise me on the method of overcoming this defect. (Kerala State)

Many spices are used in the preparation of pickles and most of these spices carry heavy loads of bacteria and fungi. As long as the moisture content remains below 10 per cent, they are safe. But during storage and transit as the moisture increases, first fungi begins to appear and later on bacteria. Hence there is necessity to treat the raw materials (spices) with antifungal agents (formalin in vapour phase or acid) depending upon the type of fungi and bacteria. After pretreatment they should be dried to bring down the moisture to 10 per cent or less and packed.

Sodium benzoate upto 250 p.p.m. is permissible in pickles. This will check the spoilage.

Maleic hydrazide

E (IS) 12

I want to use maleic hydrazide on my onion farm. Please send me particulars regarding its availability and price. (Saurashtra)

Maleic hydrazide can be obtained from Messrs Bombay Chemicals Private Ltd., 129, Mahatma Gandhi Road, Bombay-1 in the form of either MH-40, or MH-90; these numerals denote the percentage of active ingredient in the product. On the basis of this active ingredient, *i.e.*, whether it is 40 per cent or 90 per cent, it may be diluted to form an aqueous solution to contain 500 parts per million of the active ingredient of maleic hydrazide. The price of maleic hydrazide can be had from the above firm.

Analysis of honey

E (IS) 13

I shall feel obliged if you can let me know the analysis of pure honey. How can we find out the adulteration in honey? (Rampur, U.P.)

The essential constituents of honey are dextrose, levulose and sucrose together with small amounts of mineral matter, proteins, wax, pollen and sometimes mannitol and dextrans. The composition of honey varies considerably and is largely influenced by the feeding of bees. Honey is generally analysed for the following constituents: moisture, ash, mineral matter, degree of polarisation, sugars (mainly glucose, fructose and sucrose), dextrin, acidity and protein. Tests for enzymes and microscopic examination are also carried out. The details of the analysis of honey can be had from any of the following books:

- (1) 'The structure and composition of foods. Vol. IV' by A. L. Winton & K.B. Winton; Published by John Wiley & Sons, Inc., New York.
- (2) 'The Chemical analysis of foods', by H. E. Cox; Published by J. & A. Churchill Ltd., 104, Gloucester Place, London.
- (3) 'Aid to analysis of food and drugs', by J. R. Nichols; Published by Bailliere, Tindall & Cox, 7-8 Henrietta Street, Covent Garden, London.

As regards the quality of honey, there is no simple test to ascertain the same. Genuine and pure honey contains 15-18 per cent water, 70-75 per cent invert sugars (about 35 per cent glucose and 40 per cent fructose) and from a trace to 5 per cent sucrose. Honey is generally adulterated with cane sugar and corn syrup which are cheaply available. The presence of these can be detected by the usual analytical methods of different sugars. Another method is to take the polarimeter reading. Genuine honey gives a levorotatory reading (*i.e.*, turns the plane of polarised light to the left) while cane sugar and commercial glucose are dextro-rotatory (turn the plane of polarised light to the right). Honey is generally adulterated with invert sugar. It is, however, difficult to detect this as the composition of invert sugar is similar to that of sugars in honey. Artificial invert sugar prepared by acid hydrolysis can be detected by the Fiehe's test based on the presence of a compound, namely, 5-hydroxy methylfurfuraldehyde. A positive Fiehe's test is indicated by the appearance of bright red colour when a small volume of ethereal extract of the honey is evaporated and mixed with resorcinol and hydrochloric acid.

Meat curries

E (IS) 14

Please recommend some recipes for preparing Moglai type of curries from mutton, chicken, etc. (Calcutta)

The recipes for mutton and chicken curry are given below:

MUTTON CURRY

Ingredients:

Leg of mutton	..	1250 g.
Coriander	..	10 g.
Turmeric	..	3 g.
Cardamom	..	1 g.
Cloves	..	1 g.
Cinnamon	..	2 g.
Chilly powder (dry)	..	4 g.
Pepper	..	1 g.
Cumin seeds	..	3 g.
Mustard	..	2 g.

Garlic (fresh)	...	11 g.
Onions	..	130 g.
Ginger (green)	..	26 g.
Chillies (green)	..	10 g.
Coriander leaves	..	14 g.
Sweet neem leaves	..	3 g.
Lime (medium size)	..	1 No.
Tomato	..	126 g.
Salt	..	30 g.

CHICKEN CURRY

Chicken (2 while) prepared	..	1250 g.
Coriander	..	10 g.
Turmeric	..	2 g.
Cordamom	..	2 g.
Cloves	..	1 g.
Cinnamon	..	1 g.
Chilli powder (dry)	..	2 g.
Pepper	..	1 g.
Cumin seed	..	2 g.
Mustard	..	3 g.
Onions	..	110 g.
Ginger (green)	..	12 g.

Preparation:

MUTTON CURRY: Ground spices, onions, garlic and green leaves to a paste and fry in *ghee*. Later boil with suitably cut meat pieces in enough water. Sliced tomatoes and lime juice are also added during boiling. Continue boiling till the meat is half cooked.

CHICKEN CURRY: Ground spices and onions to paste and fry in *ghee*. Further process is similar to that of mutton curry preparation.

MOGLAI CURRY: In the Moglai preparation of mutton and chicken curry, additional ingredients which may be added are poppy seeds and dry cocoanut.

Papad khar

E (IS) 15

We shall be much obliged if you please let us know the chemical composition of 'papad khar' which is used in the manufacture of papad. What is the ideal proportion to be used? (Rajasthan)

'Papad khar' is a mixture of potassium carbonate and sodium bicarbonate. It is used to make papad light and crisp. The proportion to be used will depend

upon the mode of preparation but generally for one seer of flour, five tolas are recommended.

Menthol

E (IS) 16

We would like to know whether menthol could be prepared from mint or pudina. If so, kindly furnish us the details of manufacture of the same. (Rajasthan)

Menthol can be prepared from mint or *pudina*. Menthol is an essential constituent of mint oil. The process of recovering menthol from mint oil is one of isolation. The procedure is as follows:

On cooling to a low temperature, crude (natural) mint oil yields from 40-50 per cent of *l*-menthol crystals and from 50-60 per cent of partly dementholized mint oil. The further process of isolating menthol crystals needs well equipped plant. For this purpose, it is necessary that natural oil is first freed from moisture, filtered and later on poured into metal containers which are placed in a freezing mixture for about 24 hours. The dementholized oil is drawn off at the bottom of the container whereas the menthol crystals remaining in the vessel are dissolved in a solvent with warm water and recooled later on. Recrystallised menthol is then left to dry at normal temperature for several days in a kiln where any adhering solvent or oil may evaporate.

For further details of the process, you may refer to the book, 'The essential oils' by Guenther, Vol. 3; Published by M/s D. Van Nostrand Company, Inc., New York.

Tartaric acid

E (IS) 17

Would you please inform me whether tartaric acid can be used for cooking in place of tamarind without any harmful effects? (Bombay)

Tartaric acid may not have any harmful effect on health if substituted for tamarind in small quantities. There is, however, evidence in literature to show that consumption

of large quantities of tartaric acid can result in some damage to the kidneys, as tartaric acid is not absorbed in the human system. It is because of these reasons that the use of citric acid is preferable in foods. We have not carried out any study of its physiological properties and, therefore, regret our inability to clarify this issue. The work on this aspect may have been done at the Nutrition Research Laboratories, Hyderabad. We suggest that you may kindly seek their advice also.

Custard powders

E (IS) 18

I shall be glad to receive from you some formulas for the manufacture of flavoured and coloured corn flour powder and custard powder. Kindly also enlighten me on the mode of packaging the products particularly to prevent insect infestation during storage. (Bombay)

(i) Flavoured and coloured corn flour is obtained by milling corn into fine flour, adding flavouring agents like vanilla essence and permitted colouring matters.

(ii) The recipe for corn flour custard powder is as follows:

Arrow root	..	8 oz.
Best corn flour	..	7 oz.
Powdered saffron	..	10 g.
Oil of bitter almonds	24 drops	
Oil of nutmeg	..	12 drops

Mix the powders in a mortar, gradually add the oils and pass through a fine sieve. This powder is used in the preparation of custards along with egg yolk. The preparation of vanilla custard is given below:

Sugar	..	7 oz.
Corn flour	..	$\frac{3}{4}$ oz.
Yolks	..	5-8
Milk	..	$1\frac{3}{4}$ pints

Vanilla bean
or essence

.. 1

Place in a mixing bowl sugar, yolks and corn flour, mix all well together and stirring all the time, add the boiling milk together with the vanilla bean boiled in it. Continue to stir on the stove until the custard has acquired the desired consistency. If required later to stir in some whipped cream, the recipe given above should be amended by including five sheets of gelatine; in winter time, four sheets are probably sufficient.

The powders can be packed in hermetically sealed tin containers. This helps in storing the product for a long time free from any insect attack. The cheaper method, however, would be to pack in cardboard cartons lined inside with polyethylene. The outside of the cartons or cases can be coated with an insect-proof emulsion to prevent the insect infestation.

MOST MODERN SPECTROPHOTOMETERS

Ex: M/s BECKMAN INSTRUMENTS INC. U.S.A.

DK2 ULTRAVIOLET—NEAR INFRA-RED SPECTROPHOTOMETER

This Ratio Recording Spectrophotometer has an unique combination of the true double beam principle with single photo receiver and amplifier, utilizing a High Frequency Beam Chopper and switching system. It exploits such advantages of ratio recording as free from drift and line variations and at the same time avoids the problem of photo tube matching and ageing.

Range: Ratio Recording 200 - 3,200 m/u Energy Recording 185-3,500 m/u
Resolution: 0.3 m/u at 220 m/u, 2.5 m/u at 1,000 m/u
5 m/u at 2,500 m/u.

Other instruments: Infra-Red Spectrophotometers, IR7, IR5 and IR4, Model B Spectrophotometer for Visible Region, Model DU for UV-visible regions spectrophotometer.

More particulars can be had from:

Sole Agents:

TOSHNIWAL BROTHERS (PRIVATE) LIMITED

198, Jamshedji Tata Road, Bombay 1.

Branches:

Kachery Road,
Ajmer (Rajasthan)

172, Dharamtolla St.,
Calcutta 13

14-B/4 N.E.A.
Uttari Marg,
New Delhi 5.

Round Tana
Mount Road,
Madras 2.

Notes and News

STATISTICAL NOTES

Food Production Statistics for September and October, 1959

Name of Industry	Units of measurement	September 1959		October 1959	
		No. of units	Production	No. of units	Production
1. Biscuit ...	Tons	33	1,855	31	1,680
2. Confectionery ...	"	37	1,245	34	1,210
3. Flour milling ...	"	55	79,844	53	83,111
4. Butter ...	"	5	144	5	150
5. Cashewnut ...	"	9	914	8	1,152
6. Gram flour and Dal...	"	1	354	1	394
7. Aerated water ...	Gross bottles	35	81,332	31	80,997
8. Beer ...	Bulk gallons	2	94,557	2	1,72,375
9. Indian made foreign liquor ...	"	14	65,351	11	41,711
10. Country spirit ...	L.P. gallons	22	3,91,160	21	3,44,737

(Ministry of Commerce and Industry, Government of India)

All-India Final Estimate of Potato, 1958-59

	1958-59 (Final Estimate)	1957-58 (Partially Revised Estimate)
Area (thousand acres) ...	882	794
Production (thousand tons) ...	2,319	1,966

(Economic and Statistical Adviser, Ministry of Food and Agriculture, Government of India)

Services of retired scientists

The Indian Council of Agricultural Research has decided to initiate with effect from 1st April 1960 a scheme for the utilisation of the services of retired/retiring scientists in the field of agriculture, animal husbandry and allied sciences. All applications for grant and also details of the scheme can be obtained free of cost from the Secretary, I.C.A.R., Krishi Bhavan, New Delhi.

NEWS BRIEFS

Fat content of milk: A new German instrument (manufactured by Loede and Co., Drabenderhöhe, nr. Cologne) designed to measure

the mean fat content in the milk supply to dairies by means of samples has been tested by the German Federal Milk Research Institute, Kiel. Two of these instruments were installed in the training dairy of the Institute. It was found that, with small quantities, the sample automatically taken by the apparatus was not strictly proportional to the total quantity of the milk unless the static pressure and flow conditions were identical. To determine the measuring accuracy of the apparatus, the milk from two transports was thoroughly tested on 21 days.

The results obtained with the sampling instrument were found to be accurate within a tolerance of

0.05 per cent. But such accuracy can only be obtained if the apparatus is suitably calibrated in each individual case (*Food Manuf.*, September 1959, p. 358).

Milk as vitamin D carrier:

People of all age groups are liable to suffer from vitamin D deficiency. The natural vitamin D contents of many of our traditional nutrients are too low to make up the deficiency. It is therefore necessary to enrich them artificially. Milk is particularly suitable as a vitamin D carrier as it reaches the greatest number of people in one form or another. The problem has been investigated in great detail by the Research Institute for Milk Vitaminisation at Frankfurt-on-Main. Systematic tests, including controlled tests on rats, have shown that ultraviolet irradiation is to be preferred to the admixture method (*Food Manuf.*, September 1959, p. 358).

Casein plastics: Casein, together with formaldehyde, was the basis of one of the first man-made plastics ever used. In spite of its comparatively low price, however, casein has not been able to compete with modern plastics, mainly for two reasons: the hardening of casein mouldings takes too much time and their plasticity is too low. Attempts have been made to overcome these difficulties by using dispersions.

Skimmed milk represents casein in very fine dispersion which can be hardened within a very short time. Tests proved that dispersion-hardened casein can be obtained through precipitation from formalin-treated skimmed milk. By mixing skimmed milk with plastic dispersions and processing the mixture like casein, it was found possible to produce new types of plastics-cum-casein combinations. The attempt was also made to polymerise the disperse casein with urea-formaldehyde into a new type of plastics. The experiments had only limited success. It is still necessary to improve the

technical properties of these new products which, if suitably improved, might be used economically as raw material for plastics, glues, insulating materials, etc. (*Food Manuf.* September 1959, p. 358).

Fish quality determination: A rapid physical test based on the refractive index of eye fluids has been developed as a criterion of the quality of fresh haddock. The results obtained were shown to be correlated with the organoleptic scores made on cooked flesh from the same fish and with the time of storage at refrigerator temperature above freezing.

Optical density tests on haddock eye fluids gave promising results but were not as suitable as were refractive index measurements for quality indication.

Enzyme action was thought to be the cause of changes in the physical properties of haddock eye fluids during storage at refrigerator temperatures above freezing since there was no evidence that bacterial composition was involved in such changes (*Food Manuf.*, September 1959, p. 358).

Improving colour of meat products: According to tests carried out at the Institute for Food Hygiene at Budapest Veterinary College, it is possible to improve the colouring of cured and minced meat by adding ascorbic acid or sodium ascorbate.

In this case, and in the presence of an adequate quantity of nitrite, the development of the red curing colour is greatly accelerated during curing and smoking. It is also possible, in this way, to improve the taste of the product. The admixture of ascorbic acid need not exceed 0.05 per cent of the quantity of meat. The use of ascorbic acid may also be advantageous in the case of sausages when the ascorbic acid may be added during final mixing. From a colouring point of view, however, it is preferable to add the ascorbic acid several hours earlier. A considerable percentage of the vitamins thus added can still be detected in the finished product

(*Food Manuf.*, September 1959, p. 359).

Thawing of frozen fish: The industrial thawing of frozen fish, which normally takes up to 24 hr. in air can now be done in about 15 min. by dielectric heating. This new development, which solves a major problem of the fish industry, is the result of work at the Torry Research Station of the D.S.I.R. A patent application has been made for the method which is of great economic significance in the quick frozen food industry, and may have wider application.

The method, known as dielectric thawing, depends on the fact that if any material is placed between, but without touching, two metal plates which are charged with an alternating voltage of many thousands of volts at a frequency of about 40 million cycles per second, energy is produced in the material in the form of heat. Under well defined conditions, fish may be uniformly thawed throughout a block of the frozen material—either as whole fish as in the case of herrings, or as fillets. It is possible to control conditions far more accurately than in existing methods, for example, so that individual fish in a block may be separated while remaining partially frozen.

Laboratory-scale experiments at the Torry Research Station, Aberdeen have shown that it was possible to use dielectric heating successfully on tiny pieces of frozen fish. Pilot scale apparatus, using slightly modified equipment which is commercially available, was therefore set up. The problem of 'runaway heating' in which small portions of blocks of fish absorbed the major part of the available energy and became cooked, while the rest of the block remained hard frozen had to be overcome, but now the fish may be fed into the machine on an endless belt and thawed in 15 min.

At present fish is thawed by laying it out in the air; it is sometimes, in addition, sprayed with water. Under these conditions,

fish on the outside of a block thaws quickly and begins to deteriorate, while that in the middle remains frozen. The new method requires no handling during thawing, is quick and therefore keeps deterioration to a minimum, and the equipment does not take up much floor space.

The capital cost, about £10,000 for equipment to thaw 1 ton of fish per hr., is said to be comparable to that for freezing equipment of similar capacity. Running and depreciation costs appear to compare favourably with the costs of existing methods of thawing (*Food Manuf.*, September 1959, p. 364.)

Whisky waste for animals: An example of the conversion of material previously wasted, into a useful by-product can be seen on the D.S.I.R. stand at the Scottish Industries Exhibition, where Scottish Malt Distillers, Ltd., are showing a sample of a new animal food which has been produced entirely from the residues of malt whisky distillation.

The new product, known as Malt Distillers Dried Solubles (or Malt D.D.S. in brief), is said to have a high protein value and vitamin B content. It is stated that farm experiments and laboratory tests with poultry have already proved its success, and its greatest value is likely to be as an inexpensive source of 'growth factors', essential to improving the health and size of table poultry and pigs. Production will be at the rate of 100 ton per week by the end of the year.

Until recently, pot ale or spent wash in the Scottish malt whisky industry was either put to waste or evaporated and sold as a fertiliser (*Food Manuf.*, September 1959, p. 365.)

'Palatable' dehydrated bananas: Mr H. Lowenstein, a South African industrial chemist, has invented a technique for dehydrating bananas that promises to take up all the 'slack' in banana supplies by converting them into a highly palatable dried food for both the South African and overseas markets. The

banana co-operative at White River, in the Transval, has taken a half share in the company formed recently to manufacture and market the product. The dehydrated banana is a light yellow, crisp, flaky substance, easily digestible and with an agreeable flavour, proposed to be sold in packets as a sweetmeat, which can also be used as a porridge since it is soluble in milk (*Food Manuf.*, September 1959, p. 368).

Swedish pork preservation:

A new heat-treatment process to improve the keeping qualities of pig carcasses is now being used in a Swedish slaughterhouse, it is reported from Stockholm.

The special automatic equipment used, first subjects the carcasses to a temperature of 650 degrees Centigrade for 15 seconds in a special type of hot-air oven then transports them to singeing flame for another four seconds, and finally washes them in a special solution.

Other pig slaughtering concerns, both in Sweden and abroad, are reported to have shown interest in the process (*Food Technol. Austr.*, September 1959, p. 527).

Baby food dry freezing process:

A new line of frozen baby foods, produced by a dry-freezing process, has been developed by the General Foods Corporation, New York, and is now undergoing market tests. The new process, the company said, represents the most significant development in infant feeding since the introduction of processed baby foods. The line includes 17 items in the vegetables, soups, dinners and fruits classifications, and is being sold under the Birds Eye label.

They consist of 'free-flowing food crystals', which can be prepared for serving by placing in a dish, adding hot water, or cool water for fruits, and stirring. No initial thawing is required. Secondly, not only can they be stored indefinitely, as are regular frozen foods in the freezer compartments of refrigerators, but they also can be stored, unlike many regular

frozen foods, for as long as a month in other parts of the refrigerator (*Food*, October 1959, p. 401).

NEW INDIAN STANDARDS

Pest control products: In IS:561:1955 and IS:562:1955, chromatographic cum polarographic method had been prescribed for the determination of gamma-BHC content in BHC dusting powders and BHC water dispersible powder concentrates. Since facilities for testing in accordance with the combined method are not at present available in many laboratories of the country, it was felt necessary to specify either chromatographic or polarographic method instead of the combined method. Hence, IS:561:1958 Specification for BHC Dusting Powders (Revised) and IS:562:1958 Specification for BHC Water Dispersible Powder Concentrates (Revised) have been published (*ISI Bull.*, July-August 1959, p. 182).

Icing sugar: Icing sugar is manufactured in India by pulverizing superior vacuum pan sugar or refined sugar in a ball mill or other disintegrator with or without the addition of a small quantity of any edible starch. It is mostly used for dusting confectionery and for dressing cakes, pastries and other bakery products. The Indian Standard Specification for Icing Sugar (IS:1152:1958) prescribes the requirements in respect of moisture; reducing sugars; starch (moisture-free); and total of starch (moisture-free), and sucrose (*ISI Bull.*, July-August 1959, p. 183.)

Covering chocolate: Covering chocolate is broadly classified as unsweetened covering chocolate, sweetened covering chocolate and milk covering chocolate. The Indian Standard Specification for Covering Chocolate (IS:1163:1958) covers all these three types of chocolate and prescribes the requirements and the methods of test for determining moisture, total fat, sugar (sucrose), total ash, acid insoluble ash, crude fibre, starch

and non-fat milk solids. Microscopic examination has also been included in the standard to help visual detection of adulteration (*ISI Bull.*, July-August 1959, p. 183).

Cocoa powder: Two grades of material, namely drinking (high-fat) cocoa-powder and low-fat cocoa-powder, abbreviated as 'DC' and 'LF', respectively, have been specified in the Indian Standard Specification for Cocoa-Powder (IS:1164:1958). The standard prescribes the requirements and methods of test for determining moisture, cocoa-butter, total ash, acid insoluble ash, alkalinity of ash, and crude-fibre content in the sample obtained by the specified method. The defatted material is required to have a characteristic appearance as shown in photo-micrograph included in the standard (*ISI Bull.*, July-August 1959, p. 183).

DRAFT INDIAN STANDARDS

Methods of examination and analysis of milk: Quality of reagents; sampling of milk; organoleptic test; temperature; method of determination of density; sediment test; method of determination of pH: clot-on-boiling (COB) test; alcohol test; alizarin-alcohol test; ten-minutes resazurin test; methylene blue reduction (MBR) test; phosphatase test (Short test); direct microscopic count; acidity; methods of determination of rapid acidity, fat, solids-not-fat, adulterants, freezing point of milk (Hortvet method); methods of detection of preservatives, neutralizers, mastitis; and test for sterilized milk have been prescribed in the draft Indian Standard Methods of Examination and Analysis of Milk: Part I—Rapid Examination of Milk. The draft has been prepared to provide uniform methods which can be rapidly used even under rural conditions in a small laboratory.

Accurate determinations of various constituents for specific purposes and elaborate methods for bacteriological analysis of milk will be covered in Parts II and III,

respectively of this draft specification (*ISI Bull.*, July-August 1959, p. 187).

Tapioca products for animal feed: Tapioca products form an important substitute for grain in animal feeds, especially in the States of Kerala and Madras.

Two items of tapioca products have been covered in the following two draft specifications:

1. Tapioca Chips for Animal Feed, and
2. Tapioca Flour for Animal Feed.

These draft specifications prescribe requirements and methods of test, and also lay down details of sampling, packing and marketing.

The drafts have been prepared at the instance of the Tapioca Market Expansion Board, Government of Kerala (*ISI Bull.*, Sept.-Oct. 1959, p. 233).

INDIAN PATENTS

(A few of the Patent Applications notified as accepted in Part III, Section 2 of the Gazette of India, June 6-27, 1959 are given below:)

61535. Concentration and preservation of coconut milk: Concentrating the coconut milk to reduce its water content, adding to the concentrate a preservative, an antioxidant and a stabilizer and stabilizing for 1 to 10 minutes at a temperature of 170°-220°F.—Patented by A. Sundaralingam and V. Perampalam.

63339. Rice bran oil extraction: From rice bran using a solvent through a closed circuit under controlled pressure.—Patented by Armour Research Foundation of Illinois Institute of Technology.

64762. Colouring composition for foodstuff: Comprises in dissolving a fatty acid containing from 16 to 22 carbon atoms in a vegetable oil and dispersing a carotenoid dyestuff in the solution.—Patented by F. Hoffmann-La Roche and Co. Aktiengesellschaft.

61580. Process for the sterilization of milk: Prewarming milk to 145°F, subjecting prewarmed milk in the form of a thin flowing film to direct heat exchange contact at 300°F, holding milk at said temperature for 1½ seconds and reducing the temperature.—Patented by Daveat Milk Process Company.

62616. Improvements in or relating to herbicides: Containing herbicide selected from the group consisting of 2, 3, 6-trichlorobenzoic acid, a salt thereof and a second herbicide such as 3-p-chlorophenyl-1, 1-dimethyl urea.—Patented by Heyden Newport Chemical Corporation.

64600. A new composition of resins and articles comprised thereof: Consists of polyethylene, carbon black and a polymer of a miscible organic peroxide.—Patented by Godfrey L. Cabot, Inc.

62423. Improvements in or relating to herbicides: Comprising 2, 3, 6-trichlorobenzoic acid and a herbicidal adjuvant.—Patented by Heyden Newport Chemical Corporation.

63266. Process for the preparation of a new type of tea or coffee beverage: Sugar or glucose is dissolved and boiled, and tea leaves or coffee powder is added; after cooling the liquid is strained and then added household vinegar and then it is aerated, or canned by using carbon dioxide.—Patented by P. S. Mehta.

65897. Pigmented polyethylene composition and process therefor: Forming a mixture of carbon black, particulate polyethylene and water, and fluxing the mixture until all the water is eliminated.—Patented by Union Carbide Corporation.

FOREIGN PATENTS

813,725. Pudding compositions: A pudding composition which, when stirred with cold milk and allowed to stand, gives a pudding having a similar texture and consistency as a cooked starch pudding, comprises pregelatinised starch, a

di-alkali pyrophosphate milk protein coagulant, a tri-alkali orthophosphate coagulation accelerator, and sugar. Preferred compositions contain 1-10 per cent of the sodium salts of the coagulant and accelerator.—Patented by Monkhouse and Glasscock, Ltd. (*Food Manuf.*, September 1959, p. 370).

813,731. Food products: Small dumplings, known by their Italian name of 'guocco' or 'gnocchi', are prepared by mixing wheat semolina with a dry starch, heating the mixture of dry ingredients, adding boiling water, and kneading to form a dough which is then separated into pieces which are finally dusted with flour and left to cool.

The gnocchi of the invention retains its white colour during storage for a longer period than previously known types and the danger of pieces sticking together during storage is reduced. It is preferred to use a dry potato starch.—Patented by G. Fioravanti (*Food Manuf.*, September 1959, p. 370).

814,871. Blanching or precooking: Claims a method and apparatus for blanching peas, beans or the like, which comprises continuously passing the peas, which may be fresh, dried or soaked, through a preheated aqueous liquid in a vessel at such a rate that, when the peas leave the treatment vessel, they are sufficiently blanched. The peas are discharged from the vessel through a rising conduit opening into the bottom of the vessel and passing to a device where the peas are separated from the liquid, which is then recirculated. This discharge conduit at no point rises above the liquid level in the treatment vessel, and as a result, always contains both peas and liquid.—Patented by Mitchell Engineering, Ltd. (*Food Manuf.*, September 1959, p. 370).

814,872. Blanching or precooking: A method and apparatus similar to those claimed in 814,871 are disclosed, but in this invention the peas are passed countercurrent to steam, being sprayed with suffi-

cient water to maintain a surface film thereon. The treated peas are separated at the base of the treatment vessel and the separated liquid can be re-used to pre-soak more peas or may be recycled to the treatment vessel.—Patented by Mitchell Engineering, Ltd. (*Food Manuf.*, September 1959, p. 370).

814,549. *Pectin*: A liquid pectin containing composition, which is adapted to be made relatively quickly into a milk-containing table jelly by the simple step of merely admixing it with milk without the application of heat, comprises an aqueous solution containing low methyl pectin substantially completed dispersed therein, and sweetening and flavouring constituents, the pH of the solution being within the range of from about 3.8 to about 4.5.—Patented by Chivers and Sons, Ltd. (*Food Trade Rev.*, July 1959, p. 20).

815,354. *Orange juice*: A method of producing a dehydrated orange juice, having an open sponge like structure, from a liquid orange juice concentration, includes the steps of raising the temperature of the concentrate rapidly to 140°—

155°F., simultaneously reducing the pressure to about 5/16 in. mercury, maintaining the product at such elevated temperature and reduced pressure until it has been thoroughly puffed and then rapidly reducing the product to room temperature while maintaining it under reduced pressure and grinding the resultant product to a fine powder and adding a crushed mixture including orange oil.—Patented by Vacu-Dry Company (*Food Trade Rev.*, September 1959, p. 56).

815,465. *Preserving*: Relates to the preservation of proteinaceous foodstuffs, *e.g.*, meat and fish in hot tropical regions where rapid decomposition occurs due to the high moisture content of these foods, using amylaceous products such as potato starch or manioc which dry very easily: the foodstuff in the natural undried state is minced and mixed with starch or flour in the proportion of from 40-80 per cent by weight of the undried mixture, and dried at a low temperature to give a powder which is a concentrated food, perfectly preserved, for use in stews and similar dishes without any substantial loss in either the taste or food value of the meat

or fish.—Patented by F. E. dr Vries (*Food Trade Rev.*, September 1959, p. 56).

815,369. *Depodding machines*: A pea vining or pea and bean depodding machine of low weight output ratio so that it can readily be made mobile, comprises a series of revolving beaters with adjacent beaters revolving in opposite directions, the beaters being disposed in the space between moving members one of which has opening therein to allow separated peas to pass there-through, the beaters projecting the pea vines against the moving members which propel the vines and waste from beater to beater.—Patented by Mather and Platt, Ltd., (*Food Trade Rev.*, September 1959, p. 56).

814,924. *Milk concentrate*: Relates to the production of a dry powdered fat-containing milk concentrate which is immediately dispersible in water to form a smooth non-settling and stable dispersion, and is capable of retaining these properties with extended storage.—Patented by American Home Products Corp. (*Food Trade Rev.*, September 1959, p. 58).

Chewer's favourite

ASOKA SCENTED BETELNUT POWDER

Manufacturers: M. K. Krishna Chetty, Post Box No. 106, Coimbatore

Information from Foreign Journals

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Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Equilibrium relative humidity (E.R.H.) of garlic powder, by Pruthi, J. S., Singh, L. J. and Lal, G., *J. Sci. Fd. Agric.*, 1959, 10 (7), 359.—For systematic studies on packaging requirements and storage characteristics of foods in general and dehydrated foods in particular, the measurement of Equilibrium Relative Humidity (E.R.H.) is of considerable importance. Little published information is available on E.R.H. of garlic powder which appears to be a very highly hygroscopic product. This paper covers this important aspect of garlic powder.

Based on sorption isotherm or E.R.H. curve, the following conclusions have been drawn:

1. Garlic powder is a highly hygroscopic product, picking up moisture even at 20 per cent R.H.

2. For a typical garlic powder (moisture 6 per cent), the equilibrium relative humidity at 25°C. is about 13 per cent.

3. The critical point for garlic powder from caking viewpoint was found to be at 10.6 per cent moisture level, danger point at 9.5 per cent and safety range between 9.5 and 10.6 per cent moisture level.

R.C.B.

Utilization of mango waste, by Pruthi, J. S., Krishnamurthy, G. V. and Lal, G., *Indian Food Packer*, 1959, 13 (4), 7.—Reviewing briefly the researches conducted at Central Food Technological Research Institute, pertaining to the chemistry, physiology, nutritive value and technology of mango, the available literature on the utilization of mango waste (stones and peels) has been reviewed (38 references). The important aspects covered are the composition of mango seed

kernel as compared to cereals and tapioca flour, supplementary and biological value of kernel protein, recovery of fat and starch from kernels, utilization of kernel flour as human feed, animal feed and fertilizer; its medical uses; the physico-chemical characteristics of mango kernel fat as compared to animal and vegetable fats and oils, uses of kernel oil and use of seed-meal and dried mango peel as cattle feed.

R.C.B.

Utilization of tomato waste, by Krishnamurthy, G. V., Pruthi, J. S. and Lal, G., *Indian Food Packer*, 1959, 13 (5), 7.—The available literature on the utilization of tomato waste (peels and seeds) has been reviewed (24 references). Resins and varnishes prepared from tomato peel, seed oil, seed meal surfactants from seed oil and utilization of marc as cattle feed have been discussed.

R.C.B.

Utilization of citrus waste, by Parekh, C. M., Pruthi, J. S. and Lal, G., *Indian Food Packer*, 1959, 13 (6), 7.—Reviewing briefly the researches conducted at Central Food Technological Research Institute, pertaining to the chemistry and technology of citrus products, the available literature on the utilization of citrus waste (peels, marc and seeds) has been reviewed (80 references). The important aspects covered are essential oils, dried peels for stock-feed, seed-oil, pectin and bioflavins, etc.

R.C.B.

Studies in the preservation and storage of passion fruit juice *Passiflora edulis* Sims. I. **Ascorbic acid retention**, by Pruthi, J. S., *Indian Food Packer*, 1959, 13

(7), 7.—A detailed study on the effect of various factors like deaeration, methods of preservation, types of containers (bottles, plain and A. R. lacquered cans) and storage temperatures, etc., in ascorbic acid retention in processed passion fruit juice (*Passiflora edulis*, Sims.) has been reported. Difficulties encountered in flash-pasteurization of the juice have been discussed. The effect of various processing operations on the physico-chemical composition (°Brix, acidity, pH, ascorbic acid, carotene, etc.) of the juice was negligible.

During storage, there were no changes in °Brix, acidity and pH. Ascorbic acid decreased with the increase in storage temperature, loss being maximum at 37°C. and minimum in frozen and cold stored samples. At the four storage temperatures, namely, 37°C., 24-30°C., 5-7°C. and -6.6°C. (20°F), the per cent retention of ascorbic acid ranged from 26.3 to 29.9, 72.3 to 75.0, 92.4 to 95.4 and 98 per cent respectively. The corresponding figures for 2 and 3 years' storage periods have also been presented. High storage temperature considerably contributed towards the formation of apparent ascorbic acid, which was again found to be maximum at 37°C. and minimum in frozen and cold stored samples. There was not much variation in ascorbic acid retention under different treatments and methods of preservation, the order of variation being within 5 per cent. No dehydro-ascorbic acid was detectable in 3 year old samples stored at 37°C., while at low temperature, it constituted only 3-5 per cent of the total ascorbic acid. The anaerobic destruction of ascorbic acid in processed passion

fruit juice has been suggested and discussed.

R.C.B.

Preparation of pectin from raw papaya (*Carica papaya*) by aluminium chloride precipitation method, by Bhatia, B. S., Krishnamurthi, G. V. and Lal, G., *Food Technol.*, 1959, 13 (10), 553.—An investigation on the preparation of pectin from raw papaya by aluminium chloride precipitation method has shown that concentration of 0.5 per cent aluminium chloride in the cold at a pH of 3.8-4.0 gives the maximum yield of pectin. Precipitation at 70°C. lowers the yield, though the quality of pectin is not much affected. Yield of pectin prepared from second and third extracts is the maximum. Jelly grade of pectin goes on increasing upto three extractions after which it starts decreasing. Jelly grade of pectin prepared from

peel of raw papaya (18-20 per cent peel in the fruit) is lower than that prepared from peeled fruit. However, jelly grade of pectin prepared from whole fruit is only slightly lower than that from peeled fruit. Peeling of the fruit is, therefore, not considered necessary. Storage of extract without added SO₂ for 4 days at 2-5°C. or with SO₂ for 4 days at room temperature (20-25°C.) does not seem to affect the jelly grade of the pectin. Methoxyl content of the pectins prepared from extracts stored upto 15 days with the addition of SO₂ at room temperature or without SO₂ at 2-5°C. seems to remain unaffected. Most of the soluble solids of papaya mince are leached out by two cold water extractions of 5 minutes each. Loss of pectin in leached water is practically negligible. Optimum conditions for extraction and purification of pectin have been worked

out. Merits of the AlCl₃ precipitation method as compared to the alcohol precipitation method are described.

B.S.B.

Thermal stability of allinase and enzymatic regeneration of flavour in odourless garlic powder, by Pruthi, J. S., Singh, L. J. and Lal, G., *Curr. Sci.*, 1959, 28 (10) 403.—Allinase present in fresh garlic cloves may be inactivated by blanching in boiling water for 2½ minutes. Possibility of regeneration of flavour in odourless garlic powder by adding the enzyme extract, allinase has been shown though practical difficulties of high cost, mode and time of incorporation of enzyme preparation and the stabilization of the enzyme preparation under ordinary conditions of storage are indicated.

B.S.B.

PART II (Indian)

ANALYTICAL

Limitations of the ferric chloride method for the assay of vitamin B₆, by Singh, C. and Kannan, L. V., *J. sci. industr. Res.*, 1959, 18C (8), 144.—The colour reaction of FeCl₃ with pyridoxine is made use of for the colorimetric estimation of the vitamin. A variety of compounds such as tannins, phenolic compounds, anthocyanins, etc. react with FeCl₃, thus making the method non-specific although it has been claimed otherwise. The authors have re-examined in this study the specificity of FeCl₃ colour reaction for the estimation of vitamin B₆ in the presence of other B-complex vitamins, amino-acids, carbohydrates, inorganic salts, etc., which are usually present in pharmaceutical preparations. The reaction of FeCl₃ with three forms, *viz.*, alcoholic, aldehydic and amine forms of vitamin B₆ has also been studied. Colour intensities of the various reaction mixtures were measured in a Klett-Summerson

photoelectric colorimeter using filter No. 500 and the absorption maxima were determined using a Unicam spectrophotometer S.P. 500. The results show that ferric chloride is not a sensitive reagent for the assay of vitamin B₆, especially in the aldehyde and amine forms. The method is also non-specific as revealed by the results obtained in presence of the interfering substances. Of the 10 water-soluble vitamins studied, only thiamine hydrochloride, choline chloride and inositol do not react with FeCl₃ either alone or in presence of pyridoxine. All the amino acids studied are found to contribute to the intensity of the colour while reacting with FeCl₃ in the absence or presence of pyridoxine. The reaction has been studied in presence of several other miscellaneous substances, out of which sorbitol and ferrous gluconate have pronounced effect in intensifying the colour. A few of the substances studied have a negative influence on the intensity of the colour. The

results, therefore, clearly indicate the limitations of the FeCl₃ method for the assay of vitamin B₆.

K.L.R.

Formamide as an eluting agent for sugars, by Misra, S. B., *J. sci. industr. Res.*, 1959, 18 C (8), 155.—In the chromatographic analysis of carbohydrates, acetic acid is used to elute the coloured spots and this, however, has some limitations. The author has used, in this study, formamide as the eluting agent to obviate the difficulties. Glucose has been chromatographically estimated by using formamide to elute the coloured spots cut out from the developed chromatogram. The optical density of the eluates was read in a Klett-Summerson photoelectric colorimeter using blue filter (420 mμ). The results have been compared with the readings obtained with acetic acid as eluting agent. Optical density readings of the eluted colour at intervals of 1, 2, 20 and 24 hours are given. It is found that elution with formamide is completed within one hour

while acetic acid requires 24 hours. Further, the intensity of colour with acetic acid as eluant goes on increasing as time elapses. Besides glucose, other sugars like galactose, ribose and sugar acids like galacturonic acid have been found to give complete colour elution with formamide.

K.L.R.

BIOCHEMISTRY AND NUTRITION

Terramycin and growth: Part III—Protective action on certain tissue constituents during protein fasting and regeneration in rats, by Balakrishna Rao, T., Tamhane, D. V. and Sreenivasan, A., *J. sci. industr. Res.*, 1959, 18 C (8), 137.—On a low methionine-low choline diet based on Bengal gram (90 per cent), terramycin stimulates the growth of weanling rats both in the presence and absence of vitamin B₁₂ and pteroyl glutamic acid (PGA) in the diet, even when they are paired-fed.

Growth stimulation is accompanied by improved nitrogen efficiency and increased liver stores of vitamin B₁₂, PGA, riboflavin, flavin adenine phosphate (FAD) and nitrogen, and of plasma proteins and choline. A thinning of the intestinal wall is also observable in antibiotic-fed animals.

During protein starvation, rats receiving PGA and vitamin B₁₂ lose more weight than those not receiving the vitamins, apparently as a result of greater loss of body fat. Terramycin feeding results in protection against depletion of body proteins and maintains improved liver and plasma protein levels which are restored to normal on protein refeeding. Reduction in liver PGA and plasma choline is considerable and the levels are not restored to normal on protein refeeding.

Terramycin feeding exerts protection against the depletion of mitochondrial succinoxidase activity during protein starvation. While loss in liver xanthine oxidase activity is complete, the losses in

riboflavin and FAD are small during protein starvation. Loss in vitamin B₁₂ on protein starvation occurs in the nuclear and supernatant fraction in the groups without (PGA plus B₁₂) and in all fractions in groups receiving these vitamins.

Terramycin and growth: Part IV—Studies on rice diets, by Rao, T. B., Tamhane, D. V. and Sreenivasan, A., *J. sci. industr. Res.*, 1959, 18 C (9), 157.—A rice (90 per cent)-lysine (0.2 per cent)-threonine (0.2 per cent) diet supports better growth of rats than one based on rice (90 per cent) only but causes increased deposition of liver fat. Terramycin or PGA and vitamin B₁₂ do not stimulate growth on such diets nor do they cause lowering of liver lipids. A rice (60 per cent)-legume (30 per cent) diet supports better growth than the rice-lysine-threonine diet, and partly corrects deposition of fat in liver observed with the latter diet. Stimulation of growth, by terramycin or by vitamin B₁₂ and PGA, has been observed with the rice-legume diet and is accompanied by improved liver levels of nitrogen, riboflavin, choline and vitamin B₁₂ and of plasma proteins and choline.

Effect of glucose-cycloacetate (hydrolysed) on glycogenesis and glycogenolysis in liver and diaphragm, by Nath, M. C. and Khanade, J. M., *J. sci. industr. Res.*, 1959, 18 C (9), 169.—The effect of glucose-cycloacetate on glycogen synthesis in liver and diaphragm, and glycogenolysis in liver has been studied *in vitro*. Glucose-cycloacetate (GCA) promotes glycogen synthesis in liver and diaphragm in 36 hr. fasting rats, when glycogen storage in liver and diaphragm is very low, *i.e.*, 0.6 mg./100 mg. tissue wet weight. In animals fed the normal diet, where liver glycogen values were as high as 30 mg./g. tissue wet weight, GCA caused rapid glycogenolysis rather than glycogen synthesis. During such glycogenolysis, glycogen values of liver and diaphragm reach a minimum level

in 90 min. after which glycogen synthesis begins in the presence of GCA. In the absence of GCA, however, the value of glycogen declines further.

Distribution of nitrogen in breast milk of Indian mothers, by Bhavani Belavady, *Indian J. med. Res.*, 1959, 47 (220).—Sixty-seven samples of milk from women in different stages of lactation were analysed for the non-protein nitrogen, amino acids, creatine and creatinine. Twentynine samples of milk were analysed for casein, albumin and globulin.

The protein and non-protein nitrogen were higher in milk samples obtained within the first month of lactation. The protein content remained constant after this fall.

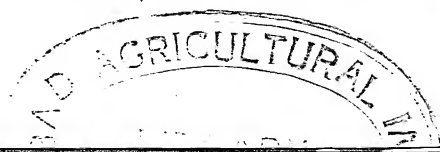
The non-protein nitrogen, amino acids nitrogen, creatine and creatinine were lower in milk samples obtained one year after delivery. The creatine content was rather high.

The casein content was lower than the reported figures, while the whey proteins were within the normal range.

Studies on lactation and dietary habits of the Nilgiri hill tribes, by Bhavani Belavady, *et al.*, *Indian J. med. Res.*, 1959, 47(2), 235.—The results of an investigation on the food habits, diet intake, lactation customs, chemical composition of breast milk and infant weaning practices prevalent among the four Nilgiri hill tribes, *viz.* Todas, Kotas, Irulas, and Kurumbas are discussed.

The food habits of all the tribes were similar and resembled in general those observed in the low socio-economic group of South India. The intake of calories among Todas of all age groups and Kota adults was considered satisfactory. However, the protein intake in members of both the tribes was found to be slightly low. The calorie and protein intake of Irulas and Kurumbas was found deficient.

Majority of the women in tribes studied, were found to breast-feed



their infants for periods up to 2 to 3 years. Supplementary foods were started invariably in the earlier half of first year and the impression was gained that the supplements were of poor quality.

The chemical composition of the breast milk with regard to the proximate principles was found to be generally similar to that of the poor South Indian women.

Chemical composition of human milk in poor Indian women, by Bhavani Belavady and Gopalan, C., *Indian J. med. Res.*, 1959, 47 (2), 235.—Milk samples from 191 mothers in different stages of lactation were analysed for total solids, fat, protein, lactose, vitamin A, thiamine, riboflavin, ascorbic acid, total mineral matter, calcium, phosphorus, sodium, potassium, magnesium, iron, copper and zinc. The concentration of all the constituents studied, except thiamine, was higher in the first month after delivery than in the later stages of lactation. The proximate principles compared well with the reported values from countries with better diets, but the vitamins were lower. After the first month of lactation, neither the stage of lactation nor the parity of the mother seemed to affect the chemical composition of milk significantly. There was no correlation between the iron content of milk and the haemoglobin levels. The rise in haemoglobin brought about in 6 anaemic mothers with iron treatment was associated with a fall in iron and concentration of their milk. Samples of milk from pregnant women showed a marked increase in the protein concentration and a relative fall in calcium concentration.

FRUIT AND VEGETABLE PRODUCTS

Oxalate content of plant tissues, by Srivastava, S. K. and Krishnan, P. S., *J. sci. industr. Res.*, 18 C (8), 146.—Oxalates are widely distributed in the plant kingdom, mostly as calcium oxalate crystals and to a smaller extent in the water-

soluble form. In this investigation, the AA. have determined the soluble and insoluble oxalates present in some edible as well as wild plant tissues. *Alocasia* (3 varieties), *Colocasia* (2 varieties), *Calladium* sp., spinach (2 varieties), amaranthus, cauliflower, knol-khol, beet, turnip and lettuce have been used for the analysis. Analysis has been done with different parts of the plant tissues, viz., leaves, stalk, flowers, tuber and roots. Freshly harvested tissues of the plants were boiled with water and filtered to obtain the water extract containing the soluble oxalates. For total oxalate estimation, the tissues were boiled with dilute HCl and filtered. The two extracts were neutralised by adding ammonia, deproteinised by adding phosphotungstate and the oxalic acid precipitated as calcium oxalate. The oxalate precipitate was used for estimation in the usual way against permanganate. The values are expressed in terms of dry weight of tissues. It is found that the water-soluble oxalate forms 12-80 per cent of the total oxalate. The roots in general contain the highest percentage of water-soluble oxalate, although the calcium uptake in the plant takes place through the root system. All the samples analysed contain soluble oxalates thus indicating that the entire calcium of the plant tissue is bound in insoluble form. Calcium is thus rendered unavoidable in the diet consisting of the plant tissues. The significance of the results on utilization of calcium present in the tissues by human beings has been discussed. It is indicated that consumption of large quantities, of the leaves of beet, spinach, *Colocasia* and *Alocasia* may lead to acute calcium deficiency.

K.L.R.

MICROBIOLOGY

Vitamin B₁₂ producing mutant strains of *Streptomyces olivaceus*, by Misra, J. and Vora, V. C., *J. sci. industr. Res.*, 1959, 18 C (8), 153.—In this study, ultraviolet irradiation of *Streptomyces olivaceus* has been tried to improve its vitamin B₁₂

producing capacity. The culture of *S. olivaceus* obtained from U.S.A. produced 100 µg/ml. of vitamin B₁₂ under the experimental conditions. The culture growth was kept at a distance of 4.5 cm. exposed to ultraviolet light produced by a Westinghouse sterilamp No. WL 782 for varying periods of 10, 20, 40, 80, 120 and 100 seconds. The exposed petri dishes were incubated for five days. The colonies giving clear exhibition zone with *E. coli* were picked out, plated and then stock cultures isolated from them. These were grown in soyabean meal and defatted groundnut cake media for 5 days. The fermented broth was acidified to pH 5.5, sterilized and assayed for vitamin B₁₂ content using *Ochromonas malhamensis* as the test organism. The results of the assay show that the production of vitamin B₁₂ by *S. olivaceus* can be increased by about 9 times by irradiating the organism with ultraviolet light.

K.L.R.

Assimilation of amino acids by *Streptomyces olivaceus*, by Maitra, P. K. and Roy, S. C., *J. sci. industr. Res.*, 1959, 18 C (9), 161.—The utilization and elaboration of various forms of nitrogen by *Streptomyces olivaceus* have been studied both in the presence and absence of glucose and oxygen. The assimilation of various amino acids by the organism and the ability of the resting cells to oxidize them have also been investigated.

Under aerobic conditions, addition of glucose to the growth medium exerts a sparing action on nitrogen utilization while under aerobic conditions, glucose addition exerts no such effect; anaerobic conditions do not also favour synthesis of vitamin B₁₂ by the organism. The rate of utilization of lysine, aspartic acid, glutamic acid and threonine by the organism is higher than that of phenylalanine, leucines, valine, α-alanine, methionine and tyrosine, both in the presence and absence of glucose. In the presence of glucose a preferential enrichment of the free amino

acids pool with respect to glutamic acid is observed throughout the fermentation period. The high rate of oxidation of DL-aspartic acid and L-glutamic acid by the organism suggests that a tricarboxylic acid cycle might be operative. Glycine and threonine, which have been shown to be biosynthetic precursors of vitamin B₁₂, are oxidized by the organism.

OILS AND FATS

Biogenesis of oil in ripening coconut and arecanut, by Kartha, A. R. S., Sethi, A. S. and Narayanan, R., *J. sci. industr. Res.*, 1959, 18 C (9), 172.—The free acids present in appreciable amounts in the crude fats of coconut and arecanut during the earlier stages of ripening do not contain any butyric

and higher fatty acids, indicating thereby a similarity in the nature and proportions of free acids present in the seeds of mono- and dicotyledonous plants during ripening.

Both coconut and arecanut exhibit a decrease in iodine value of oil during ripening; this phenomenon has been observed for the first time in these two monocotyledonous plants. Increased elaboration of lauric and myristic acids is observed in the later stages of ripening of both these fruits: in the case of arecanut a twelve-fold increase in the production of saturated acids (largely myristic acid) is observed after c. 25 per cent of the reserve fat has been laid down. Since lauric and myristic acids are intermediates in the biosynthesis of 16-18 carbon acids, this shows that any of the enzyme systems

involved in the two carbon-stage-wise elongation of the fatty acid chains can be selectively synthesized in the same depot at any time without reference to the other systems present. The chainlength-regulating systems in the fat depots are thus laid down as a collection of independent units; the continuous production of all these in the same relative proportions is only a coincidence in seed fats which do not show any variation in chainlength composition during ripening. The absence of changes in chainlength-composition of seed fat fatty acids during changes of habitat temperature of the same seeds shows that, unlike the desaturating systems, the production of chainlength-regulating systems is not influenced by habitat temperature changes.

PART III (Foreign)

ANALYTICAL

The presumptive detection of some antibiotics in foods, using a simple microbiological test, by Van Der Mijl Dekker, L. P., *et al.*, *J. Sci. Fd. Agric.*, 1959, 10 (9), 475.—A simple and sufficiently sensitive test for the presumptive detection of antibiotics in foods has been developed, based on the principle that the food under investigation is mixed with double-strength agar containing triphenyltetrazolium chloride as an indicator of bacterial growth. The agar dispersion so obtained is streak-inoculated with suitable test strains and incubated, using as a blank a mixture of agar and an identical food sample known to be free from added antibiotics.

For the presumptive detection of antibiotics *Staphylococcus aureus* and *Streptococcus cremoris* are used as test organisms. For use in the confirmative and completed tests the usual selection of test bacteria and strains, which have been rendered resistant to a certain antibiotic, may be used.

Chromatographic isolation of citric acid and lactose from skim milk, by Lucas, J.M., *et al.*,

J. agric. Fd. Chem., 1959, (9), 638.—Present methods of separating the lactose and citric acid from milk do not yield pure compounds. In this paper, the authors have described a chromatographic procedure using ion exchange resins for isolating lactose and citric acid in pure form and in good yields from skim milk. The procedure consists in first precipitating the casein fraction from skim milk by adjusting the pH to 4.5 using 3N HCl. After removing the casein precipitate and washing it, the whey along with the washings is adjusted to pH 5.5 with 3N NH₄OH and heated at 85°C. for one hour. The whey proteins that separate are filtered off while hot. The resulting filtrate and washings are adjusted to pH 6.8 with 3N NH₄OH, heated at 80°C., for half an hour and the precipitate removed by filtering through a Reeve-Angel N230 filter paper. The filtrate is then heated to boiling in presence of Norit A, which is a decolourising charcoal. The solution is filtered immediately to yield a clear, colourless and protein-free filtrate containing lactose and citrate. The citrate-lactose solution is passed through ion exchange

resin columns arranged in series with the cation resin column above the anion resin column. The eluate containing lactose, is collected, concentrated under vacuum and crystallised by adding 95 per cent ethyl alcohol. The lactose is recrystallised from water and alcohol. The citric acid that has been absorbed by the anion exchange resin is diluted with 6N formic acid. The eluted fraction is concentrated under vacuum, removing all the formic acid and neutralised with NaOH. The citric acid is crystallised out as the sodium salt by adding absolute methanol. The crystals are washed with methanol and dried overnight. The purity of the isolated lactose and citric acid crystals were established by carbon and hydrogen analysis. The yields of lactose and citric acid are 70-80 per cent and 60 per cent respectively.

K.L.R.

Determination of dextran and starch in cane juices and sugar products, by Nicholson, R. I. and Horsley, M., *J. agric. Fd. Chem.*, 1959, 7 (9), 640.—Sugar cane, cane juice, and various products obtained

therefrom frequently contain significant quantities of dextran and starch. Existing methods were not suitable for the rapid assay of these impurities in the presence of sucrose. A method is described for the rapid assay of mixtures of dextran and starch. Starch is determined colorimetrically and dextran turbidimetrically after enzymatic removal of the starch. Both of the impurities can affect technologic processes in cane sugar manufacture. Starch in raw sugar is associated with problems of filtration and in cane juice is related to the phosphorus content. The presence of dextran can indicate delay in harvesting cane or spoilage in juice.

Evaluation of Lea's aldehyde determination method, by Tamsma, A. and Powell, R. D., *J. agric. Fd. Chem.*, 1959, 7 (9), 643.—Lea's method for determination of aldehyde in fats is excellent for n-heptanal. For normal aldehydes with more than seven carbon atoms, recovery decreased with increasing chain length and limiting values were reached with the C_9 and C_{10} aldehydes. For 'aldehydes' from autoxidized milk fat the value found by Lea's method is arbitrary, because these carbonylic compounds do not behave like heptanal. Incomplete recovery can be caused by low solubility in water and low reactivity with bisulfite. Too high recovery may be obtained with unsaturated carbonyl compounds as a result of reaction of the double bonds. Reaction products and yields were examined by isolation of the aldehyde by solvent extraction after decomposition of the bisulfite complex. 'Milk-fat aldehyde' was of ketonic character; the yield was about 1/3 to 1/10 as compared to synthetic aldehyde.

Flame photometric determination of calcium, magnesium and potassium in canned tomatoes, by Luh, B. S. and Niketic, G., *Food Res.*, 1959, 24 (3), 305.—Details have been given of the flame photometric method for determining calcium, magnesium and potassium in canned whole tomatoes,

using a Beckman DU spectrophotometer adapted for flame analysis. Besides, the versene extraction method of determining calcium is compared with the ashing method. The former gave lower results than the latter method in respect of calcium, presumably because of an interference in the calcium spectrum caused by the large amount of sodium introduced as the tetra-sodium salt of EDTA, and other constituents present in tomatoes. The authors have discussed the factors influencing the emission intensity of calcium and indicated the importance of accurate control of the calcium content in canned tomatoes.

B.V.S.

ANTIBIOTICS

Effect of storage and of cooking on chlortetracycline residues in meat, by Escanilla, O. I., Carlin, A. F. and Ayres, J. C., *Food Technol.*, 1959, 13 (9), 520.—To determine the residual CTC in meat after storage and after cooking, ground beef was treated with CTC to contain 1.7, 5.0 or 15.0 $\mu\text{g/g.}$ of the antibiotic. After about 28 hours at $42 \pm 2^\circ \text{F.}$, the residual CTC in the raw meat was about 66 per cent of the antibiotic originally added to the meat. CTC residues in the cooked ground meat decreased as the final internal temperature was increased. Residues of CTC at any given temperature were a direct function of the initial concentration in the raw ground meat. The results also indicated that residual CTC in cooked meat patties was a logarithmic function of the internal temperature at the end of cooking. In frankfurters, the greatest loss of CTC occurred during the commercial processing in the packing plant. Only about 15 per cent of the CTC added in the meat emulsion (15, 30 or 45 $\mu\text{g/g.}$) was detected in the raw frankfurters. After cooking the frankfurters in boiling water to 181°F. , the CTC concentration was reduced approximately 50 per cent. Thus processing and cooking resulted in a total inactivation of 85-95 per cent of the CTC

in frankfurters. Regardless of treatment level of CTC or the temperature attained during cooking, the antibiotic in the meat was not reduced to undetectable amounts.

Effect of antibiotics on the thermal death rate of spores of food spoilage organisms, by Denny, C. B. and Bohrer, C. W., *Food Res.*, 1959, 24 (3), 247.—The work is related to the evaluation of several antibiotics with reference to their influence on the thermal resistance of spoilage bacteria. The results of the thermal-death-time tube approach to the problem of heat-antibiotic synergism are reported. Antibiotics tested were subtilin, tyrothricin, methylol gramicidin and rhatany root extract. The concentration of the antibiotic in the substrate was usually 20 p.p.m. The spoilage organisms tested were putrefactive anaerobe No. 3679 and *B. stearothermophilus* No. 1518. The results indicated that the thermal-death rate of spores of the latter is accelerated by the addition of three of the four antibiotics tested. The antibiotics did not affect the thermal death rate of spores of putrefactive anaerobe No. 3679 to a significant degree.

B.V.S.

BIOCHEMISTRY AND NUTRITION

Effect of various levels of dietary sugar on the succinoxidase of the liver of swine and cattle, by Shirley, R. L., *et al.*, *J. agric. Fd. Chem.*, 1959, 7 (8), 568.—Three groups of swine were self-fed 0, 40, and 72 per cent of crude sugar diets from weaning until they weighed 220 ± 8 pounds. A similar group was fed the basal ration until the 40 per cent sugar diet was fed 72 to 24 hours before slaughter. The average succinoxidase activity values obtained for the liver, expressed as microliters of oxygen uptake per milligram of nitrogen per hour, for the four dietary groups were 18, 25, 24, and 56 respectively ($P < 0.01$). Aberdeen Angus heifers that weighed

709 \pm 57 pounds and were fed 0 and 3 pounds of crude sugar per day for 28 days just prior to being slaughtered had 63 ± 15 and 83 ± 10 μ l. of oxygen uptake per mg. of nitrogen per hour due to succinoxidase activity in the liver respectively ($P \leq 0.01$). Lactic dehydrogenase activity was not influenced in the liver of the heifers by the dietary sugar. Succinoxidase activity was not affected in the heart of the swine or cattle by the dietary treatments.

Toxicity of amine-extracted soybean meal, by Greenberg, J., *et al.*, *J. agric. Fd. Chem.*, 1959, 7(8), 573.—Residues of soybean meal, after extraction with primary, secondary, or tertiary organic amines, were toxic for the chick when incorporated, at levels of 20 to 40%, in an otherwise adequate diet. Approximately 80 per cent of chicks fed amine-extracted residues of soybean meal died within 10 days. Chicks fed residues after extraction with acetone, ethyl alcohol or trichloroethylene survived and appeared normal. Those fed the extracts (except the butylamine extract) were normal. Triethylamine-extracted cottonseed meal, black-eyed peas, soybean protein, zein, and Cerelese were toxic in varying degrees. Triethylamine-extracted gelatin and casein were well tolerated. Twelve amino acids failed to react with triethylamine when refluxed in the solvent for 24 hours; L-lysine monohydrochloride under the same conditions showed evidence of change in composition.

Mineral elements in fresh vegetables from different geographic areas, by Hopkins, H. and Eisen, J., *J. agric. Fd. Chem.*, 1959, 7 (9), 633.—The AA. have analysed nine fresh vegetables grown in different parts of the U.S. and widely consumed by the peoples with a view to finding out the regional and seasonal variations regarding the mineral content. The vegetables chosen are: asparagus, snap beans, cabbage, carrots, pascal celery, yellow sweet corn, iceberg

lettuce, dry yellow onions and tomatoes. The edible portions of the vegetables were dried and 2 g. of each vegetable lot was charred in a muffle furnace at 300°C. Another 2 g. portion was quickly ashed at 475°–500° C. in a muffle furnace and used for potassium determination using a Beckman DU flame photometer. The charred sample was used for spectrographic determinations of 9 elements. The maximum, minimum and average values obtained for boron, phosphorus, magnesium, manganese, iron, aluminium, calcium, copper, sodium and potassium are given for the nine vegetables. The results show marked variations between different growing areas in the sodium content of lettuce and onions and in manganese content of carrots and celery. Statistically significant differences are found in the copper and manganese contents of individual lots of sweet corn grown on the same farm. The significance of these results has been discussed.

K.L.R.

CEREALS

Proximate analysis of wheat flour carbohydrates. IV.—Analysis of wholemeal flour and some of its fractions, by Fraser, J. R. and Holmes, D. C., *J. Sci. Fd. Agric.*, 1959, 10 (9), 506.—Wholemeal flour and sieved fractions have been examined by methods previously described for the determination of starch, hemicelluloses (including pentosans), sugars and cellulose in wheat flour. With few minor modifications, they are shown to be applicable also to samples of commercial bran, endosperm and germ.

Fractionation of sorghum grain wax, by Dalton, J. L. and Mitchell, H. L., *J. agric. Fd. Chem.*, 1959, 7 (8), 570.—Crude sorghum grain wax was isolated by extracting the grain with Skellysolve B and precipitating the wax with acetone. The crude wax was fractionated by adsorption on columns of tricalcium phosphate and silicic acid. A weakly adsorbed paraffin fraction was

eluted from the silicic acid column with a small quantity of Skellysolve B. A more strongly adsorbed fraction, obtained by additional elution with Skellysolve B, was identified as esters. A third fraction was eluted with 2 per cent acetone in Skellysolve B and shown to consist of alcohols. Melting points with X-ray diffraction studies indicates that each fraction was a mixture of homologs, rather than a single compound. Of the material recovered, approximately 5 per cent was paraffins, 49 per cent was esters, and 46 per cent was free alcohols.

Cooking quality of milled white rice, by Isabel Irwin, M., *Rice J.*, 1959, 62 (13), 14.—By using standardised cooking method, the comparison of cooking quality of milled white rice of different varieties as well as those of undermilled rice kept under different methods of storage such as in dry store room, refrigerator and freezer are discussed in this article. It was found that the differences due to the method of storage in cooking quality were greater than those due to variety. Finally, it is concluded that cold storage is not essential for the maintenance of good cooking quality in milled white rice. The varieties tried were zenith, cold zenith, arkrose selection C 19, 198 and Nato.

N.A.P.

ENZYMES

Application of flavour enzymes to processed foods. II. Comparison of the effect of flavour enzymes from mustard and cabbage upon dehydrated cabbage, by Mackay, D. A. M. and Hewitt, E. J., *Food Res.*, 1959, 24 (3), 253.—In view of the importance of isothiocyanates (mustard oils) to cabbage flavour, it was felt that by assaying for the released mustard oils, either directly by gas chromatography or indirectly by paper chromatographic examination of the thioureas derived from the mustard oils, a better picture of enzymic activity would be obtained. The AA. have compared the

effects of an enzyme preparation from mustard seed with an enzyme preparation from cabbage leaves by paper chromatographic techniques. At low concentrations, five components were detected for the cabbage enzyme, but only three of these were detected for the mustard enzyme. At higher concentrations, six similar components were detected for both enzymes, while four of these were more strongly detected for the cabbage enzyme.

The comparison of the cabbage and mustard enzyme preparations indicated that the same mustard oils are released from commercially dehydrated cabbage by cabbage as well as by mustard enzyme. Mustard oils were not found in untreated dehydrated cabbage. Apparently, mustard oils are released from commercially dehydrated cabbage at a greater rate by the cabbage enzyme than by the mustard enzyme. Action of cabbage and mustard enzymes on sinigrin and sinalbin is also discussed.

B.V.S.

FERMENTATION

Reduction of aldehydes during alcoholic fermentation. Application of processing of heads, by Guymon, J. F. and Jaber, M. S., *J. agric. Fd. Chem.*, 1959, 7 (8), 576.—Aldehydes are effectively reduced by the action of yeasts during alcoholic fermentation; this provides a simple and effective method for processing heads separated during the distillation of wine into brandy. Acetal was used as the aldehyde source to characterize the ability of 14 species or strains of fermentative yeasts to reduce aldehydes. All yeasts were able to complete the fermentation of grape musts after acetal additions equal to 0.23 per cent aldehyde and all except two at the 0.46 per cent added aldehyde level. The effectiveness of reduction varies, but in all cases of completed fermentations amounts to 90 per cent or more of the quantity added with a corresponding supplement of ethyl alcohol production.

FRUIT AND VEGETABLE PRODUCTS

Effect of sugar, storage time and temperature on dill pickle quality, by Pangborn, R. M., *et al.*, *Food Technol.*, 1959, 13 (9), 489.—Quality changes in dill pickles as influenced by sugar, storage time, and temperature were considered. Genuine dill pickles varying in sugar content (0, 2, and 4 per cent sucrose, were stored at 34, 70, 86, and 98°F., then evaluated after '0', 4, 8, 16, and 32 weeks. The sample containing 2 per cent sugar was the most desirable in flavour, texture, colour, and over-all acceptability. The data suggest that sugar served to protect the pickles against adverse colour changes which occurred at the lower temperatures of storage. The pickles softened considerably with increasing time and temperature of storage except when maintained at the two lowest temperatures. Refrigeration temperature (34°F.), however, caused an undesirable colour development which had an inverse relationship to softening, suggesting that apparent colour changes were alterations in cellular structure rather than change in hue. Temperatures of 70° and 86°F. resulted in smaller quality changes than did temperatures of 34° and 98°F. The lowest quality was observed after 16 weeks of storage with little subsequent deterioration. There were no significant effects of added sugar, time, or temperature of storage upon the total acidity, pH, salt content, or vacuum of the capped jars. Good positive correlation between shear-press values and texture scores was obtained.

Effect of illumination on colour of frozen peas packaged in a transparent film, by Shepherd, A. D., *Food Technol.*, 1959, 13 (9), 539.—Polyethylene bags are now being used for packing frozen vegetables, as it is cheap and provides greater eye appeal. In this paper, the effect of exposure of the package to light in retail storage cabinets on colour has been reported. The test packages con-

taining commercially frozen peas were exposed to the light of two 20-watt fluorescent tubes at two temperatures, *viz.*, 0° and 20°F. Control packages were kept at the two temperatures in corrugated cases to prevent exposure to light. Pairs of samples were removed at weekly intervals over a 4-week period and held at -20°F. in the dark till they were analysed. One sample of each pair was used for measurements in the Gardner Automatic Colour Difference Meter while the second was used for chlorophyll determination. Organoleptic evaluation was also done by a small panel of judges. The results of reflectance measurement show that no change in colour was noticed in samples stored in the dark at either of the temperatures up to four weeks. Although there was no significant change shown from the colour measurements of the illuminated samples kept at 0°F., still the taste panel could easily distinguish the illuminated three and four week old samples at 0°F. from their controls on the basis of visible colour change. A definite colour change was noticed in the illuminated samples kept at 20°F. within a week, the change continuing throughout the four week period. The panel could detect change in colour even in four day old samples kept at 20°F. The usefulness of a lower storage temperature (0°F.) is thus clearly shown. Taste evaluation indicated a pronounced flavour change, making the peas unacceptable, in one week old samples kept illuminated at 20° F. The percentage conversions of chlorophyll to pheophytin, which may be responsible for colour change in the samples of peas are given. It was also found that frost formation was more rapid in packages subjected to illumination than in those stored in the dark.

K.L.R.

MEAT

Effect of storage conditions on some of the biochemical properties of meat and on the

physical properties of an experimental sausage, by Hashimoto, Y., *et al.*, *Food Res.*, 1959, 24 (2), 185.—The AA. have conducted investigations on the effect of storage of meat materials at 20°C. on the nitrogen extractability, the pH value and ATPase system of the muscular tissue and on the quality of sausage. Rabbit skeletal muscles were the chief materials used. Beef *M. semitendineus* was also used in a special experiment. The pH of muscle was found to be greatly influenced by the condition of animals before slaughter. The course of inactivation of myosin B-ATPase in the presence of EDTA coincided perfectly with that of myosin B-ATPase in presence of calcium. As a result of the inactivation of myosin B-ATPase in muscle, the enzymic activity of myosin B in muscle was found to be inactivated quickly during storage at 20° C.

The quality of sausage prepared from stored meat samples was examined by testing their elasticity and water-holding capacity. The elasticity of the products was found to decrease mainly in correspondance with the denaturation of myosin B in muscle, but irrespective of the nitrogen extractability. Water-holding capacity was affected considerably by pH of the meat, especially below 6.0. Experiments were done to determine whether or not the denaturation of myosin B in muscle during storage proceeds in a manner similar to that of isolated myosin B and the results obtained coincided completely with those observed in isolated myosin B.

B.V.S.

PACKAGING

Light destruction of riboflavin in partially-baked rolls, by Stephens, L.C. and Chastain, M. F. *Food Technol.*, 1959, 13 (9), 527.—It is well known that riboflavin is easily destroyed by exposure to light. Earlier work has shown that the loss of riboflavin in loaf bread is

negligible probably due to the protection provided by the crust layer against light. The vitamin is, however, lost in the case of partially baked rolls, when exposed to artificial light or sunlight. Aluminium foil used as a wrap for the rolls reduced the loss of riboflavin. The use of foils, however, increases the cost of the product. The authors have, therefore, tried out cheap wrapping materials like coloured cellophane to evaluate the extent of protection given by them. Partially baked rolls were packed in clear cellophane, amber (yellow) cellophane and Tango (orange) cellophane. The packed rolls were exposed at room temperature to 60 foot-candles of light for 1, 2, or 3 eight-hour periods simulating the 8 hours of light in 1, 2 or 3 days on the grocery store shelf. Riboflavin was determined in rolls packed in the three different wraps by the fluorometric method. The results show that the losses of riboflavin in the rolls packed in clear cellophane, amber cellophane and Tango cellophane are 16.5, 13.2 and 1.7 per cent respectively after three 8-hour periods. A greater loss (7.1 per cent) was, however, obtained in Tango-wrapped rolls after just one 8-hour exposure period. The results definitely show that coloured cellophane offers protection against the photodestruction of riboflavin. The orange cellophane affords greater protection than the yellow coloured one.

K.L.R.

STORAGE

Fumigation of maize in a large shell-concrete building, by Graham, W. M., *J. Sci. Fd. Agric.*, 1959, 10 (9), 478.—A large, sealed maize store (over one million cubic feet) was filled with methyl bromide gas and fumigation continued for five days. Gas sampling indicated excellent results. The method was cheaper and more efficient than the usual sheet fumigations. The amount of gas needed was less than

expected, and the distribution was good although no fan or gas recirculating equipment was employed. The greatest advantage was that cross-infestation was practically eliminated.

The rate of diffusion of Oxygen through grain, by Bailey, S. W., *J. Sci. Fd. Agric.*, 1959, 10 (9), 501.—The rates of diffusion of oxygen through bulk wheat, maize, barley and oats have been determined. In wheat the mean rate at 23° is 0.067 mg./sec. and a temperature dependence has been demonstrated. In maize, barley and oats the mean rates at room temperatures are 0.0558, 0.0642 and 0.0721 respectively. The volumes of the intergranular air space of the four grains have been determined.

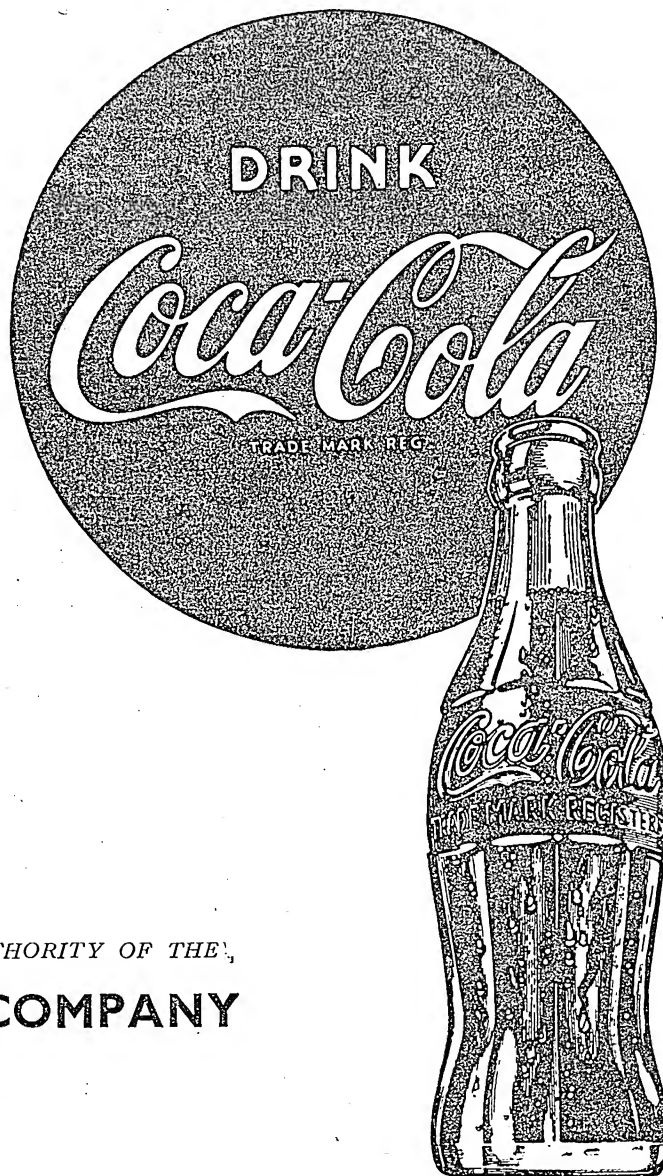
GENERAL

The disappearing vitamin, by Farrer, K. T. H., *Food Technol. Austr.*, 11 (9), 465.—The origin of vitamins and the history of vitamin B₁ are reviewed in this paper. The level of the disappearing vitamin, *i.e.*, vitamin B₁ in the average diet has fallen over the years as is evident from the table of estimates of thiamine content of historic diets of 2,500 calories. Vitamin B₁ is considered as the 'disappearing vitamin' as it is subject to considerable hydrolysis which may be rapid during cooking or heating process and slower but inexorable during storage. The thermal destruction of vitamin B₁ and the several factors responsible for it are also discussed in this paper. Like vitamins A and C which are found in appreciable quantity in dairy and citrus fruits respectively, there is no major dietary source of the vitamin B₁. The milling of wheat and rice causes adverse effect on vitamin B₁; so also the losses in kitchen are considerable. The author has also given in short the current work done on thiamine.

N.A.P.

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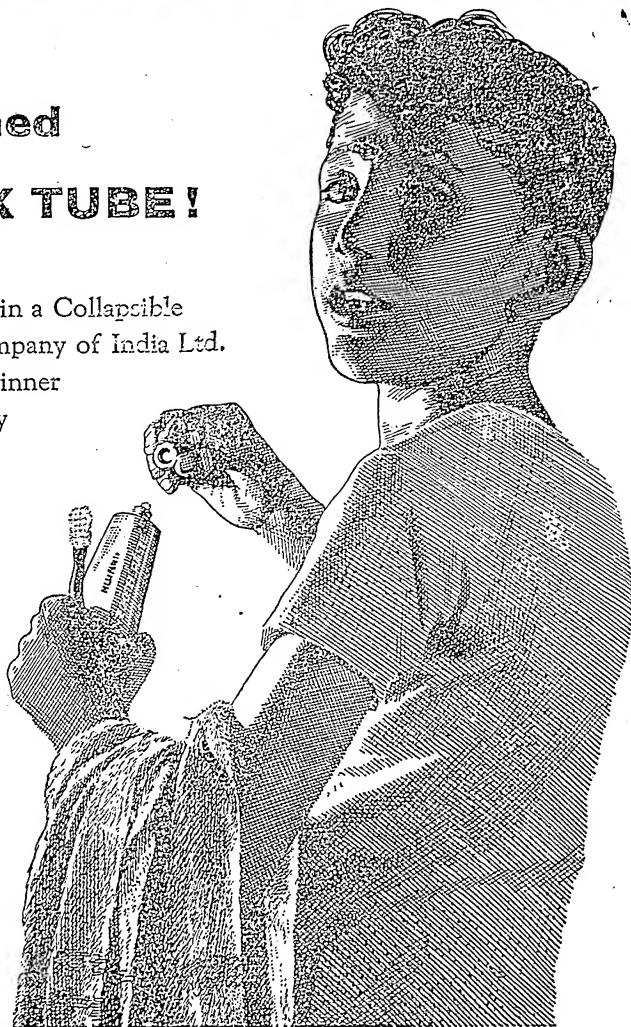
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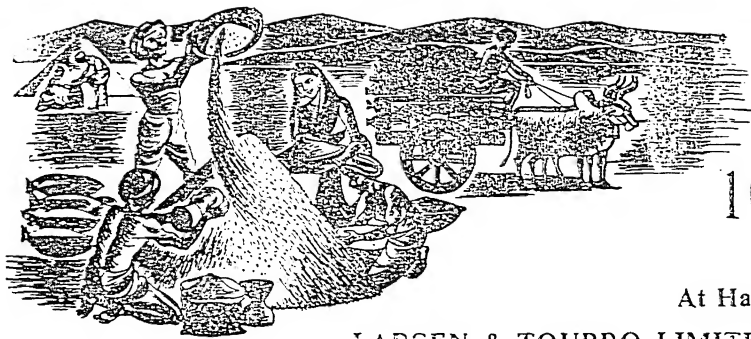
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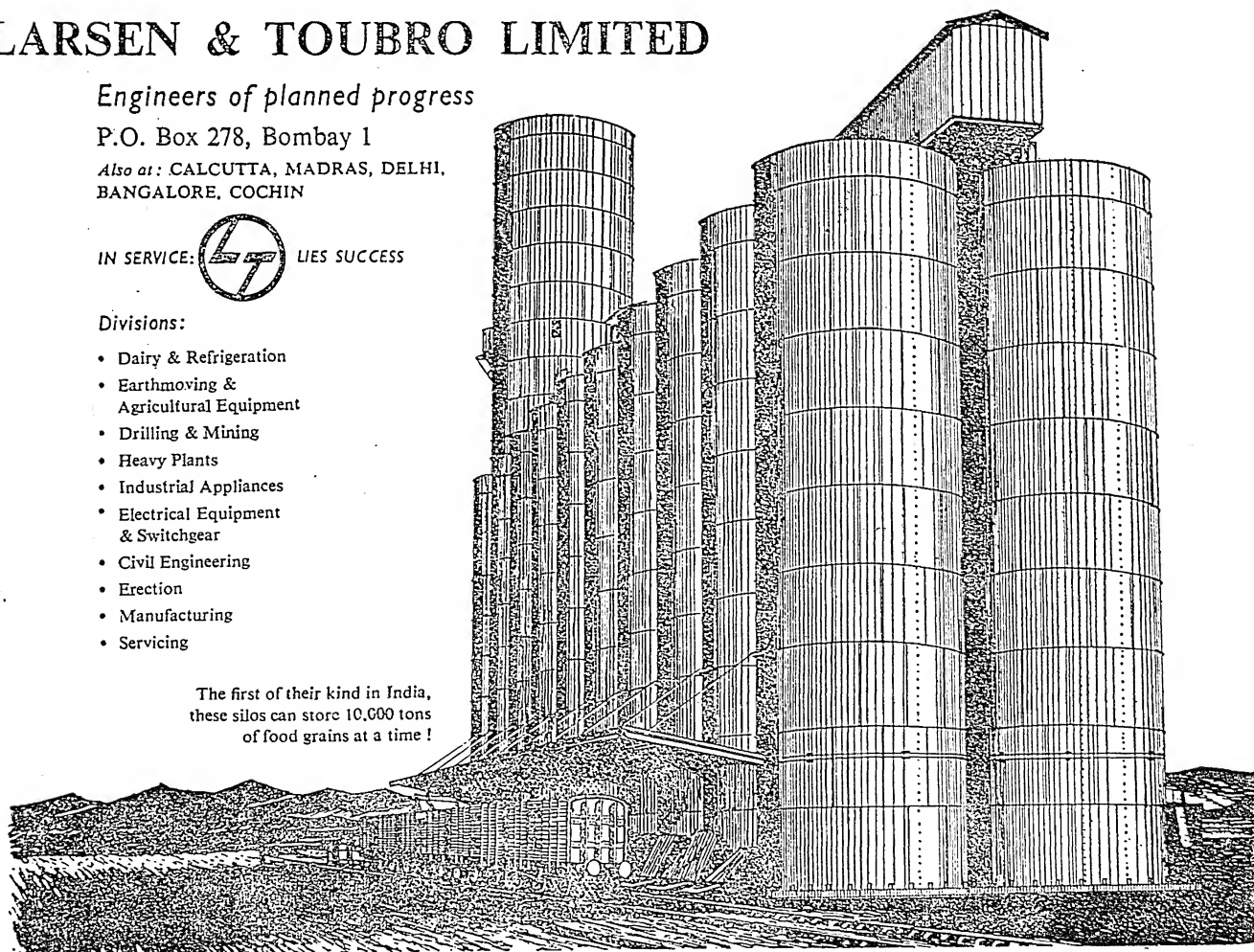
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This is a publication specially brought out on the occasion of the F.A.O. Regional Seminar on Food Technology for Asia and the Far East held in Mysore from August 1-8, 1959. It is a collection of 26 review articles, which cover exhaustively the research work done in India on some of the important aspects of Food Science and Technology, particularly those dealing with rice and rice substitutes; fruit and vegetable products; dehydration of foods; storage, packaging and transport of perishables; infant, invalid and protein-rich foods; beverages, spices and condiments; etc. The book represents under one cover the important lines of work and progress made in India in the field of Food Technology.

Price: (Bound) Rs. 10.00 (*postage extra*); £1.5.0; \$4.00.

(Ordinary) Rs. 5.00 (, ,); £0.12.0; \$2.00.

2. FRUIT AND VEGETABLE PRESERVATION INDUSTRY IN INDIA (*published in May 1956*) pp. xiv + 485. (Compiled and edited by R. C. BHUTIANI).

This publication is packed with up-to-date technical and statistical data on several aspects of the Fruit and Vegetable Preservation Industry spread over 65 papers read and presented by scientists, technologists, industrialists (manufacturers of food products, machinery, additives, containers and packaging) as well as importers and exporters. Some papers also bring out adequately the various stages of development of the Industry in the country and the handicaps with which it is faced today. The inclusion of the discussions which followed each of the papers read, has added to the usefulness of the book. It also contains the Recommendations of the Symposium submitted to the Planning Commission for consideration in respect of schemes to be included in the Second Five-Year Plan.

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3. TECHNICAL AID TO FOOD INDUSTRIES (*published in July 1954*), pp. xvi + 270.

This publication, contains the views and suggestions of prominent scientists, leading industrialists and food technologists, and Government officials on the nature of technical aid needed by different food industries in the country. Up-to-date technical and statistical data are provided and an appendix embodying the conclusions of the Symposium as well as a comprehensive index are given.

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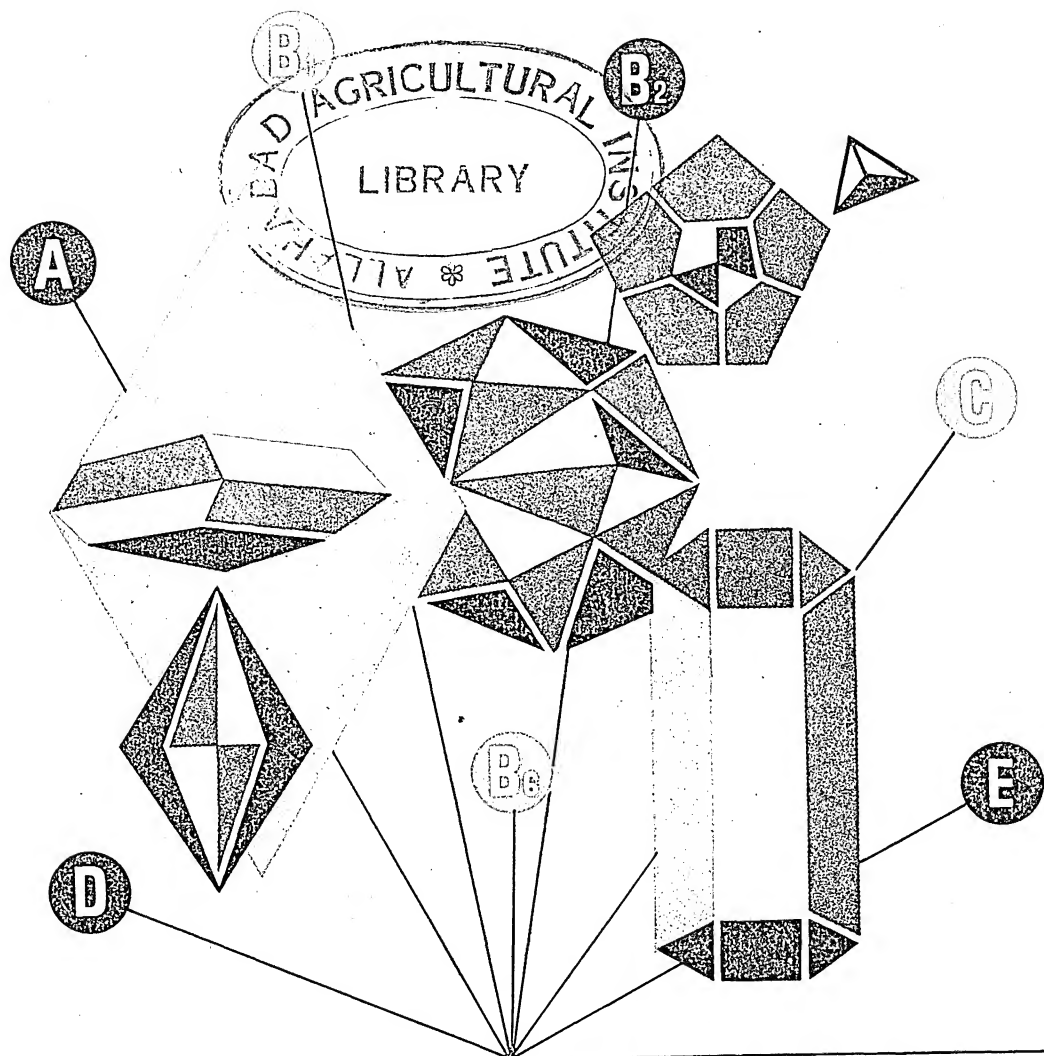
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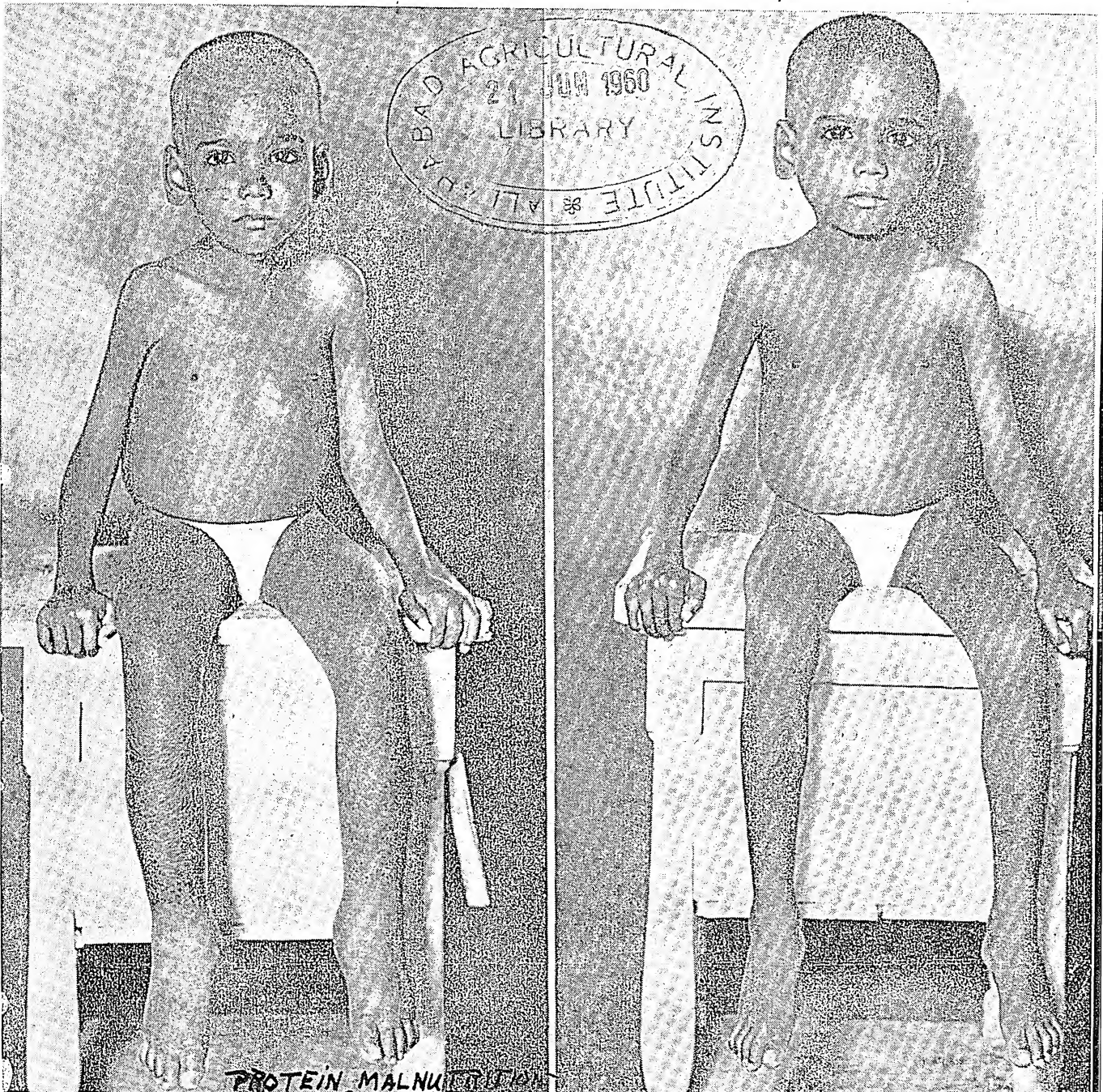


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Dr. B. C. Guha, Chairman, Chemical Research Committee and Dr. V. Subrahmanyam, Convener for the Symposium request that intimation of participation in the Symposium may be sent to Dr. A. Sreenivasan, Deputy Director, C.F.T.R.I., Mysore, as soon as possible and that a copy of the paper along with an extract of 300 words should reach him *not later than June 15, 1960*. Further details in regard to the Symposium will be communicated as soon as finalised.

EDITOR

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EFFECT OF INSECT INFESTATION ON STORED FIELD BEAN (*Dolichos lablab*)
AND BLACK GRAM (*Phaseolus mungo*)By S. VENKATRAO, R. N. NUGGEHALLI, S. V. PINGALE, M. SWAMINATHAN AND
V. SUBRAHMANYAN

(Central Food Technological Research Institute, Mysore)

Pulses constitute an important source of protein in the Indian dietary. During 1955-56 the total quantity of the various pulses produced in the country amounted to about 10 million tons¹. Pulses, being seasonal crops, are usually stored for periods varying from 6 to 12 months. During storage, the pulses are attacked by insects of the genus *Bruchus*. These insects cause heavy damage to almost all kinds of pulses. Besides affecting the market value and acceptability of the grains, infestation is also likely to affect the nutritive value and hygienic condition of the products²⁻⁴. In the present paper, the results of studies on the effect of insect infestation on some of the chemical constituents, hygienic quality and consumer acceptability of two common pulses, viz., field bean (*Dolichos lablab*) and black gram (*Phaseolus mungo*) are reported.

Materials and Methods

Field bean and black gram, free from infestation, were obtained from the local market within a month after harvest. They were stored in 'B-twill' jute bags (2'x1'). Each bag contained 7 lb. of the individual pulses. Infestation was introduced in the form of 120 eggs laid by *Bruchus chinensis* two days earlier on 100 grains of each pulse sample. The infested bags were kept in separate earthenware pots in insect-proof rooms maintained at a temperature of 85°F±5 and a relative humidity of 70-75 per cent. Insect-free samples of the pulses were also maintained under similar conditions.

All estimations were carried out on one pound lot of samples drawn from each bag at intervals of 2 months.

Only the adult stages of the insects were taken into consideration in determining the insect population. Viability was determined by incubating a representative sample (10 g.) of the seeds on moist filter paper and counting the number of seedlings at the end of 5 days. The insect fragment count of the samples was determined by the method of Harris *et al*⁵.

The samples were cleaned on a 12 mesh sieve, ground in a laboratory mill to pass through a 50 mesh sieve and the flour was used for chemical analysis. Nitrogen (both total and soluble in sodium chloride solution), fat acidity and thiamine were determined according to the methods used by Pingale *et al*². Non-protein nitrogen was estimated by precipitating the proteins in the sodium chloride extract with trichloroacetic acid. Uric acid was determined by the uricase method of Venkatrao *et al*⁶. For assessing the organoleptic quality, the procedure described by Pingale *et al*³ was followed.

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Results and Discussion

Loss in weight: Heavy losses were observed in the weight of both field bean and black gram as a result of insect attack. The loss was considerably more with the former. The results in Table I show that the beetles are prolific breeders of the pulses in store. As many as 11 insect-exit holes were observed in some seeds of *Dolichos lablab*. Therefore unless properly looked after, the seeds are liable to damage in a very short time. As this insect bores through the grain leaving the outer coat practically intact, the weight/volume ratio gives a fair index of the degree of infestation as shown in Table I. A gradual decrease in the weight/volume ratio is observed as the infestation progresses. The viability of the grain is found to decrease with the progress of infestation.

Hygienic conditions: Recent investigations have shown that uric acid, which is the main constituent of insect excreta, can serve as a good index of the unhygienic conditions in infested cereals, pulses and wheat flour^{4, 7, 8}. From the data given in Table II it will be seen that uric acid can serve as a good index of insect filth in infested field bean and black gram also. Only traces of uric acid are found in uninfested samples of pulses. The uric acid content is seen to rise with the increase in the degree of infestation as revealed by the number of insect-exit holes, insect population and kernel damage. High values for the uric acid are obtained when the kernel damage in the samples show 6.0 per cent only. Very high quantities of uric acid are found in highly damaged pulses. Uric acid which is a measure of the insect excreta present in the grain due to the movement, feeding and breeding of insects appears, therefore, to be a better index of the unhygienic conditions in grain than kernel damage.

Immature and dead insects present in the kernel also contribute to the unhygienic condition of the grains. When the grain is powdered the insects are ground into fragments. From the results in Table II it will be seen that insect fragments also are present in considerable amounts in samples containing high concentration of uric acid. Impurities due to insect activity,

though not proportional to the degree of damage, show a gradual increase with the increase of infestation.

Loss of nutrients: The results presented in Table III show slight increases in the moisture and total nitrogen content of the insect infested samples. The solubility of nitrogen in 3 per cent sodium chloride solution is found to increase as a result of infestation. But when allowance is made for the non-protein nitrogen in the salt extracts, a slight decrease in the solubility of proteins is noted. Similar observations have been reported in the case of other pulse proteins³.

A gradual increase in the fat acidity is noticed with the progress of infestation. This is in conformity with earlier observations³.

Earlier observations on insect damaged grains showed that infestation brings about a reduction in the thiamine content. In both the pulses studied here, a loss of the thiamine content was observed due to insect damage.

Organoleptic quality: The pulse grains infested to varying degrees were cooked in water and offered to a panel of 6 judges for judging the organoleptic quality. The results are given in Table IV.

The results show that as the infestation progressed, the organoleptic acceptability of the pulses was adversely affected.

Summary

Field bean (*Dolichos lablab*) and black gram (*Phaseolus mungo*) were infested with the *Bruchus* species of insects. The physical and chemical changes occurring in the grain were followed at intervals as the infestation progressed. The results showed that considerable loss in viability and weight of the pulses occurred as the infestation progressed. The uric acid content which is an index of the unhygienic conditions due to the presence of insect excreta, steadily increased as the infestation progressed. An increase in fat acidity and non-protein nitrogen and a decrease in the thiamine content were observed in the infested pulses. Pulses infested for a period greater than 2 months were not acceptable to the consumers.

TABLE I. *Insect population and the extent of loss in the weight and viability of stored field bean and black gram*

Particulars	Field bean							Black gram						
	Control (insect-free) stored for (months)				Infested at the end of (months)			Control (insect-free) stored for (months)				Infested at the end of (months)		
	0	2	4	6	2	4	6	0	2	4	6	2	4	6
Loss in wt. (%) ...	...	...	...	...	0.5	15.3	40.3	...	...	...	...	4.6	8.3	25.2
Wt./volume ratio g./cc....	0.80	0.80	0.80	0.80	0.796	0.678	0.478	0.848	0.848	0.848	0.848	0.809	0.778	0.634
Insect population per 500 g. ...	...	...	...	...	245	1,580	3,680	...	...	...	...	427	936	2,350
Kernel damage%...	...	...	...	...	6.1	62.0	94.0	...	...	...	...	6.7	15.2	45.4
Viability%...	100	100	100	100	80	25	...	100	100	100	100	75	52	24

TABLE II. *The effect of infestation by Bruchus species on the hygienic conditions of stored field bean and black gram*

Insect fragments per 100 g. of grain	...	...	...	...	890	6,970	12,000	...	...	...	...	147	2,320	6,231
Impurities (g.) per 1 lb. of grain....	...	...	...	...	1.1	2.0	3.3	...	...	...	...	0.9	2.3	3.7
Total number of holes present in 100 g. of the sample....	...	...	...	...	149	1,691	4,263	...	...	...	...	313	568	1,645
Uric acid, mg/100 g.	...	...	...	...	103	1,912	5,117	0.3	0.3	0.3	0.3	389	664	2,790

TABLE III. *Effects produced by Bruchus chinensis on the chemical composition of field bean and black gram*

Moisture% ...	10.8	10.9	11.0	11.0	11.1	11.9	12.8	10.8	10.9	10.9	10.9	10.9	11.6	12.6
Total nitrogen%	3.39	3.4	3.4	3.48	3.42	3.63	3.75	3.68	3.72	3.75	3.77	3.80	3.89	4.02
Nitrogen soluble in 3% NaCl (a) total%	1.8	1.75	1.65	1.50	1.76	2.00	2.12	1.6	1.58	1.52	1.48	1.70	1.83	1.99
(b) Non-protein nitrogen%	0.28	0.31	0.34	0.36	0.41	0.85	1.10	0.27	0.29	0.32	0.33	0.40	0.61	0.87
(c) Protein nitrogen % (by diff.)	1.52	1.44	1.31	1.14	1.35	1.15	1.02	1.33	1.29	1.20	1.15	1.3	1.22	1.12
Fat acidity (mg. of KOH required to neutralise free fatty acids from 100 g. of grain)	29.0	35.0	42.0	48.0	80.8	203	229	40.0	43.5	45.0	51.9	65.7	90.4	95.0
Thiamine (μ g/100g)	450	420	405	392	356	310	285	426	412	395	366	396	345	296

TABLE IV. *Effect of infestation by Bruchus chinensis on the organoleptic quality of field bean and black gram*

Commodity	Period of infestation (months)	Kernel damage %	Organoleptic quality of cooked product			
			Taste	Smell	Overall acceptability	
Field bean	...	0	0	Normal	Normal	Acceptable
„	...	2	6.1	Normal	Normal	Acceptable
„	...	4	62.0	Slightly bitter	Strong off-flavour	Not acceptable
„	...	6	94.0	Slightly bitter	Very strong off-flavour	Not acceptable
Black gram	...	0	0	Normal	Normal	Acceptable
„	...	2	6.7	Normal	Normal	Acceptable
„	...	4	15.2	Slightly bitter	Slight off-flavour	Not acceptable
„	...	6	45.4	Slightly bitter	Strong off-flavour	Not acceptable

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UTILIZATION OF APPLE POMACE

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A large quantity of apple pomace is left over after the preparation of juice and is generally wasted in this country. In other countries, it is utilized for the preparation of cattle feed, pectin and insect bait¹. The present paper embodies a brief account of the experimental work done at the Ramgarh Fruit Processing factory under the Directorate of Fruit Utilization, U.P. on the preparation of cider, beer, soft drink, vinegar, pectin extract and pectin from the apple pomace.

Experimental

The apple pomace and juice from Ramgarh factory were carried to Soil Chemists' Laboratory

at Chaubattia for experimental work. The pomace was obtained by pressing the minced fruit from the mixed varieties of Newton Pippin, Stirmer Pippin and Buckingham in a hydraulic press. For preservation 300 p.p.m. of SO₂ was added as potassium metabisulphite. Pomace processed the previous day was used for experimental work the following day. Apple juice heated to 185° F for 30-45 seconds and preserved with 100 p.p.m. SO₂ was stored in carboys. Pomace extract was prepared by adding five times the weight of water, boiling for 30 minutes and pressing in a hydraulic press.

COMPOSITION OF POMACE:

Proximate and mineral composition of pomace containing 76.74 per cent moisture as determined by A.O.A.C. methods is given below:

Moisture-free basis	Per cent
Total ash ...	1.65
Crude protein (N \times 6.25) ...	3.99
Nitrogen free extract ...	76.41
Ether extract ...	1.71
Crude fibre ...	16.16
Total sugar (as invert) ...	17.35
Acidity (as malic) ...	2.39
Pectin ...	16.95
Phosphorus ...	113 mg.
Iron ...	70 "
Calcium oxide ...	123 "

PREPARATION OF PRODUCTS:

(a) *Cider*: Two batches of cider were prepared using (i) pomace extract and (ii) mixture of apple juice and pomace extract in equal quantities. The Brix and acidity of pomace extract were raised to 12 and 0.5 per cent respectively by the addition of sugar and citric acid, from an initial Brix of 4 and acidity about 0.15 per cent as malic acid. The same sugar/acid ratio was maintained in the mixture of apple juice and extract. Both batches were fermented for 7-10 days using pure yeast cultures of *Saccharomyces mellis* and *Saccharomyces Cerevicea* var. *Ellipsoideus Burgandy*. After the end of fermentation the liquors were clarified with a filter press using a filteraid. The clarified liquor was bottled and pasteurised at 185-190° F for 15 minutes. When examined organoleptically both ciders were found to be acceptable. The flavour was ranked superior when apple juice was added. Further improvements could be made by carbonating the drinks. The cider from the second batch had the following composition 3.5-4 per cent alcohol, 0.49 per cent acidity (Malic), 4° Brix and 3.7 pH.

(b) *Beer*: As in the case of cider, the two batches were prepared, i.e., with and without added apple juice. Method of preparation was the same except for the addition of extract of hops to the fermenting liquor. Bottling procedure was the same as for cider. Both batches were found to be equally acceptable.

(c) *Soft drink*: The Brix of pomace extract was raised to 12 with sugar and acidity to 0.4

per cent with citric acid. The liquid after pasteurization was bottled, carbonated and fortified with Vitamin C. The product was highly acceptable with respect to taste, flavour and sugar/acid blend.

(d) *Vinegar*: Vinegar was prepared from the pomace extract by the usual two-stage method of alcoholic and acetic acid fermentation. The finished product was filtered, 50 p.p.m. SO₂ and trace of caramel colour added, bottled and pasteurized at 175° F for 20 minutes. The product had a fruity aroma and was highly acceptable.

(e) *Pectin extract*: The pomace was leached in hot water for an hour to remove sugars and after adding five times the weight of water and 1.25 per cent citric acid to the pressed pomace, it was boiled for half-an-hour, strained through mull cloth, cooled and left overnight with 700 p.p.m. of added SO₂. Next day the clear liquid was decanted off and filled in bottles or carboys. Ten lb. of this extract could set about 15 lb. of sugar after the addition of 0.5 to 0.6 per cent citric acid to give a well set jelly.

(f) *Pectin*: Pomace left over after the utilization of pomace extract for cider, beer, vinegar or soft drink was used for the preparation of solid pectin. The pomace was extracted four times with 0.02N boiling HCl (pH 2.8 to 3.0) using 1½, 1, 1 and 1 times the extractant respectively with an extraction period of 30 minutes each. After each extraction the liquid was pressed through a hydraulic press and cooled immediately. The combined extracts were adjusted to pH 4 with ammonia, clarified by decanting after leaving overnight with 200 p.p.m. added SO₂ and precipitated with 1M aluminium chloride solution. The aluminium pectinate precipitate was separated over cloth, dried at 55-60° C for about 5-6 hours in a cross-flow hot air drier and purified by two washings with acidified alcohol of about 60 per cent strength, one washing with 60 per cent alcohol and finally with 95 per cent alcohol. Finally it was dried in a cross flow cabinet drier at about 55° C for about 2 hours. In three batches prepared, yield of pectin varied from 2.53 per cent to 3.39 per cent on fresh pomace basis. Jelly grade was 280, methoxyl content (moisture

and ash-free basis) 8-9 per cent, ash 1.5-2.5 per cent and moisture 8-10 per cent. Thus its quality compared favourably with apple pectins being imported into this country at present.

All the products prepared above retained their quality when examined after a storage period of 6 months at a room temperature of 24-30°C.

Conclusions

Apple pomace left over in the apple juice factories which is generally a waste material has been utilized successfully in the preparation of good quality products like cider, beer, softdrink, vinegar, pectin extract and pectin. In case of cider, addition of equal quantity of pure juice to the pomace extract before fermentation improves the flavour of the finished product. The products have been found to retain their quality after a storage period of 6 months at a room temperature

of 24-30°C. Determination of proximate and mineral composition of pomace shows that it is a rich source of pectin and sugars. It has been shown to have good commercial prospects for the preparation of above mentioned products.

Acknowledgements

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SUPPLEMENTARY VALUE OF COMPOSITE PROTEIN FOODS CONTAINING A BLEND OF COCOANUT MEAL, GROUNDNUT FLOUR AND BENGAL GRAM TO POOR RICE DIET

During recent years considerable interest has been evinced in many countries on the utilisation of available protein-rich foods for supplementing human diets^{1, 2}. The most important source of plant proteins available in India, are the various edible oilseed meals and legumes². Studies on the utilisation of groundnut, sesame, soyabean and Bengal gram flours in the preparation of composite protein foods have been reported from this laboratory^{2, 3}. As cocoanut meal is available in large quantities as a by-product of the oil industries in certain parts of India, viz., Kerala, it was considered desirable to study the possibility of using specially prepared cocoanut meal along with other protein-rich foods for the preparation of composite protein foods.

In a previous communication⁴ from this laboratory the nutritive value of the proteins of a protein food based on a blend of cocoanut meal, groundnut flour and Bengal gram flour has been reported. In the present communication the results of studies on the supplementary value to poor rice diet of cocoanut meal and two protein foods containing cocoanut meal, low fat groundnut flour and Bengal gram flour in different proportions and fortified with calcium phosphate and vitamins are reported.

The samples of groundnut flour and Bengal gram flour used in the present studies were prepared according to methods described by Subrahmanyan *et al*². The edible quality cocoanut meal used in this investigation was the same

as that described by Krishnamurthy *et al.*⁴ Two compositions of protein foods were prepared by mixing low fat groundnut flour, cocoanut meal and Bengal gram flour in different proportions as shown in Table I. The two protein foods were fortified with vitamins A, D, thiamine and riboflavin and calcium phosphate. The chemical composition of the composite protein foods and cocoanut meal determined according to A.O.A.C. methods⁵ is given in Table II.

TABLE I. *Composition of composite protein foods*

Ingredient	Protein food I	Protein food II
	(g)	(g)
Low fat groundnut flour	48	38
Cocoanut meal	25	40
Bengal gram flour	25	20
Calcium phosphate	1	1
*Vitamin A and D premix	1	1
†Vitamin B complex premix	1	1

* 3,000 I.U. of vitamin A and 300 I.U. of vitamin D in 1 g. of low fat groundnut flour.

† 0.8 mg. of thiamine and 3.0 mg. of riboflavin in 1 g. of low fat groundnut flour.

TABLE II. *The chemical composition of cocoanut meal and composite protein foods containing cocoanut meal, groundnut flour and Bengal gram flour*

Constituent	Cocoanut meal	Protein food I	Protein food II
Moisture% ...	9.2	8.8	9.7
Protein% (N × 6.25) ...	20.2	36.5	33.3
Ether extractives% ...	9.5	7.6	8.3
Crude fibre% ...	9.9	3.0	4.4
Ash% ...	5.0	4.7	4.5
Carbohydrates% (by diff.) ...	46.2	39.4	39.8
Phosphorus (mg)% ...	443	649	645
Calcium (mg)% ...	28	477	467
Vitamin A (I.U.)% ...	...	3,000	3,000
" D (I.U.)% ...	...	300	300
Thiamine (mg)% ...	0.12	1.42	1.44
Riboflavin (mg)% ...	0.06	3.11	3.09

The supplementary value of the two protein foods as compared with that of cocoanut meal at 12.5 per cent level to poor rice diet was determined by rat growth method. The composition of experimental diets used in this investigation was the same as that described by Kuppuswamy *et al.*⁶ Four groups of freshly weaned rats, eleven in each group (6 males and 5 females) weighing between 39 to 48 g. and distributed equally according to weight and litter mates were fed poor rice diet and the same diet in which 12.5 per cent of rice was replaced by one of the two protein foods or cocoanut meal. Weighed amounts of diet were taken in feeding cups, cooked in three times the weight of water for 10 minutes by steaming and fed to animals. Records of daily food intake and weekly gain in body weight of the rats were maintained. The results are given in Table III.

The results indicate that cocoanut meal when incorporated at 12.5 per cent level increased the growth promoting value of poor rice diet. This finding is in accordance with that of earlier workers.⁷ The increase in growth rate may be due to the mutual supplementation of cocoanut proteins with that of rice proteins. The two protein foods when incorporated at 12.5 per cent level in the diet produced a marked increase in the growth rate of rats. This may be due to (1) the mutual supplementation between rice proteins and those of protein foods and (2) the supplementary effect of the calcium present in the protein foods. It may be concluded from the results obtained in this investigation that composite protein foods based on blends of cocoanut meal, groundnut flour and Bengal gram flour and fortified with calcium phosphate and vitamins will form a good supplement to poor diets consumed by vast majority of people in regions where cocoanut meal is available in large amounts.

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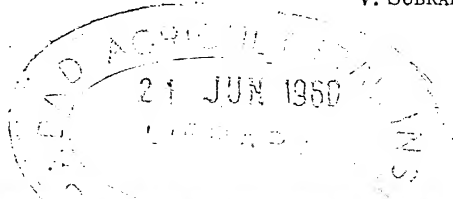


TABLE III. *Supplementary value of composite protein foods as compared with coconut meal to poor rice diet*

(Duration of experiment : 8 weeks)

Group No.*	Diet†	Average initial wt. (g)	Average daily food intake (dry wt.) (g)	Average weekly increase in wt. (g)	Results of tests of significance
A.	Poor rice diet ...	41.4	8.8	4.73	A ~ B Sig. at 0.1%
B.	Poor rice diet †coconut meal (12.5%) ...	41.4	8.8	7.30	A ~ C „ 0.1% A ~ D „ 0.1%
C.	Poor rice diet + Protein food I (12.5%) ...	41.8	10.9	14.32	B ~ C „ 0.1% B ~ D „ 0.1%
D.	Poor rice diet + Protein food II (12.5%) ...	41.8	10.8	13.59	C ~ D „ N.S.

* Each group contained 6 males and 5 females.

† Rice in poor rice diet was replaced at 12.5% level by coconut meal, protein food I and protein food II for groups B, C, and D respectively.

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STUDIES ON THE NUTRITIVE VALUE OF COMPOSITE PROTEIN FOODS BASED ON BLENDS OF GROUNDNUT, SOYABEAN AND SESAME FLOURS

It is now generally recognised that protein malnutrition is widely prevalent among children belonging to the low income groups of the population in India and several Asian, African and Latin American countries¹⁻². The most important sources of plant proteins available in the above countries are oilseeds and oilseed meals and legumes³⁻⁵. Among the oilseed meals groundnut and soyabean meals are available in large quantities while sesame, coconut and cottonseed flours are available only to a limited extent. Among the legumes, the most important are Bengal gram (*Cicer arietinum*) and various other types of grams and beans³⁻⁵. In previous papers from this laboratory Subrahmanyam and his coworkers⁶⁻⁷ reported that a multipurpose food prepared from a blend of low fat groundnut flour (75 parts) and Bengal gram flour (25 parts) and fortified with

certain vitamins and calcium phosphate formed a good supplement to poor Indian diets. In the present investigation, the nutritive value of composite protein foods based on blends of groundnut, soyabean and sesame flours has been studied.

The samples of low fat groundnut flour and sesame flour used in the present study were prepared according to the method described by Subrahmanyam *et al.*⁵ Soyabean flour was prepared as follows: Soyabean dhal was soaked in water for one minute and the excess water was drained off. The material was left for an hour so that the adhering water was absorbed by the dhal. The wet material was steamed at 10 lb. pressure for 30 minutes to inactivate the tryptic inhibitor present. The processed material was dried in a current of hot air (45°-50°C) and then

powdered to pass through a 40 mesh sieve. Two compositions of protein foods were prepared by blending the different ingredients in the proportions shown in Table I. The chemical composition of the composite protein foods, determined according to the methods of the Association of Official Agricultural Chemists⁸ is given in Table II.

TABLE I. *Composition of composite protein foods*

Constituent	Protein food I (g)	Protein food II (g)
Low fat groundnut flour ...	48	48
Processed soya flour ...	50	30
Low fat sesame flour ...	...	20
Calcium phosphate ...	1	1
Vitamin A & D premix* ...	1	1
Vitamin B premix† ...	1	1

* 3000 I.U. of vitamin A and 300 I.U. of vitamin D in 1 g. of low fat groundnut flour.

† 0.8 mg. of thiamine and 3.0 mg. of riboflavin in 1 g. of low fat groundnut flour.

TABLE II. *Chemical composition of different composite protein foods and skim milk powder (values per 100 g)*

Constituent	Composite protein foods		Skim milk powder*
	I	II	
Moisture (g) ...	8.0	8.2	4.1
Protein (N × 6.25 g) ...	47.2	45.9	36.0
Ether extractives (g) ...	14.5	12.9	1.0
Ash (g) ...	5.7	6.1	6.8
Carbohydrates (g) (by diff.) ...	24.6	26.9	52.1
Calcium (g) ...	0.664	1.132	1.257
Phosphorus (g) ...	0.732	0.757	1.01
Thiamine (mg) ...	1.78	1.8	1.2
Riboflavin (mg) ...	3.3	3.25	4.4
Vitamin A (I.U.) ...	3,000	3,000	3,000
Vitamin D (I.U.) ...	300	300	300

* Skim milk powder was fortified with vitamins A and D.

Protein efficiency ratios

The protein efficiency ratios (PER) of the proteins of different foods as compared to that of skim milk powder proteins, were determined by the rat growth method of Osborne, Mendel and Ferry⁹. Three groups of freshly weaned rats (12 in each group weighing between 40-50 g. and distributed equally according to sex, litter and body weight) were fed for a period of 8

weeks on synthetic diets containing 10 per cent of protein from the protein foods or skim milk powder respectively. Records of food consumption and weekly increase in the body weight of rats were maintained. Data regarding the PER of the proteins of the protein foods as compared with that of skim milk powder proteins are presented in Table III.

TABLE III. *Protein efficiency ratio of the proteins of composite protein foods as compared to skim milk powder proteins*

(Protein level in the diet: 10%)

Group No.	Source of protein	Average initial body wt. (g)	Protein efficiency ratio	
			4 weeks	8 weeks
A	Protein food I ...	39.2	2.46	2.07
B	" " II ...	38.9	2.72	2.30
C	Skim milk powder ...	39.0	3.46	2.71

Results of test of significance

A ~ B	significant at	not significant	5% level
A ~ C	" "	0.1% level	0.1% level
B ~ C	" "	0.1% level	0.1% level

* Each group contained 6 males and 6 females.

Overall nutritive value of protein foods

The overall nutritive value of the protein foods as compared with that of skim milk powder was determined by the rat growth method. The protein foods and skim milk powder formed the sole source of proteins, minerals and vitamins in the diet. The protein content of the diets was 16 per cent and the diet containing skim milk powder was fortified with vitamins A and D to the same extent as the protein food diets. Three groups of freshly weaned rats (14 in each group weighing between 40 and 50 g. distributed equally according to sex, litter and body weight), were fed on the experimental diets for a period of 8 weeks. Records of food intake and increase in body weight of the animals were maintained. The results are given in Table IV.

TABLE IV. *Average weekly growth of rats fed on diet containing protein foods or skim milk powder*

(Duration of the experiment: 8 weeks)

(Protein content of the diet: 16%)

Group No.*	Source of protein	Average initial body wt. of rats (g)	Average daily food intake on dry basis (g)	Average weekly gain in body wt. (g)
A	Protein food I ...	49.8	9.5	13.7
B	„ „ II ...	49.4	9.1	16.7
C	Skim milk powder ...	49.6	9.0	15.8

 $\left. \begin{array}{l} 13.7 \\ 16.7 \\ 15.8 \end{array} \right\} \pm 0.82 \text{ (24 d.f.)}$
Results of tests of significance:

A ~ B	significant	at	5% level
A ~ C	„	„	Not significant
B ~ C	„	„	„

* Each group contained 7 males and 7 females.

The results in Table III show that the PER in an 8 week period of the two protein foods were 2.07 and 2.30 as compared with a value of 2.71 obtained for skim milk proteins. These values are higher than the PER of the proteins of Indian multipurpose food (1.4) based on a blend of groundnut and Bengal gram flours reported earlier⁶. Table IV gives the mean weekly gain in weight of rats on diets on which the two protein foods formed the sole source of protein, vitamins and minerals. The results show that the diets containing 16 per cent protein from the protein

foods were as effective as skim milk powder diet in promoting growth in rats. Further investigations on the supplementary value of the protein foods to the diets of children will be undertaken shortly.

We are thankful to Mr A. N. Sankaran and Miss K. Indiramma for the statistical analysis of results.

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RECENT PROGRESS IN PROPHYLACTIC TREATMENTS FOR PEST CONTROL IN STORED FOODSTUFFS IN INDIA

By S. K. MAJUMDER AND M. MUTHU

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The earliest preventive treatment for the control of pests in food grains in the Orient was the empirical use of road dust, plant ashes and sand. This type of treatment was desired not only for killing of the initial population but also for preventing further cross infestation. The next category in the earlier prophylactic processes probably includes the principle of hermetic storage of grains in the underground pits, *khattis* and innumerable types of such structures. The other category in the earliest empirical prophylactic methods for the storage of grains was the use of solar energy for bringing the moisture content of the grains to levels inimical to insect growth. The application of inorganic salts and an array of chemicals like mercury, sulphur, wood distillation products was in vogue in the past. The mixing of dried plant parts of supposedly insecticidal nature and also the use of plant oils such as clove oil, neem oil etc., are still in vogue in many parts of the country.

The scientific studies on the problems connected with the control of insect pests of stored food grains have been started only two decades back. Considerable amount of literature has accumulated on the subject which will be reviewed in this paper with special reference to the subject of 'prophylaxis' for storage of foodgrains and their products.

Studies on inert Dusts

Narasimhan and Murthy¹ reported that burnt husk of paddy passed through 100 mesh resulted in an insecticidal dust. The efficacy of the powder was found to be as good as quartz, felspar, corundum and other minerals. It is recommended for use at the rate of 1 per cent of the dust to the total weight of the grain². Iyengar³ in a critical study on the inert dusts remarked that the paddy husk ash contained 95 per cent silica in free state, a figure closely agreeing to that of quartz. According to Fairhall⁴ silicosis is caused by free silica and not by silica in the combined state such as silicates.

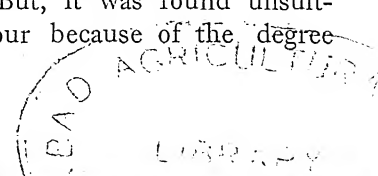
The different types of inert dusts which are mixed with the grains for their storage have been discussed by Pruthi and Singh⁵. Chatterjee⁶ studied the effects of some inert dusts on *Trogoderma granarium* (Everts).

Recently Majumder *et al*⁷ have screened through saw dusts, inorganic chemicals, clays, silica gel, charcoal, coal dust, decolourising earths, and activated charcoal. They found that all the dust particles passing through 300 mesh were more or less insecticidal in effect. They have reported that the insecticidal effects were proportional to the degree of activation of decolourising clays and activated gas absorbing carbons. They have demonstrated that by giving the zinc chloride activation treatment to charcoal and acid activation treatment to kaolinic earth the insecticidal properties of the parent materials could be enhanced considerably which was proportional to the decolourising power and gas absorbing capacity.

Studies on Insect Proofing of Containers

Apart from mixing inert dusts in the cereals pulses, potatoes, onion, garlic, turmeric, ginger, etc., the insecticidal dusts of DDT and BHC have been used extensively in India for their storage. Although, these insecticidal dusts are effective in controlling pests, their use should not be permitted for direct mixing with foodstuffs for storage unless the chronic and acute toxicity hazards to consumers of these treated articles are totally eliminated. For seed storage, direct mixing of pesticides, as a prophylactic measure is practiced extensively in India.

The prophylactic use of residual pesticides was initiated in the occidental countries along with the advent of the synthesis of organic insecticides in the moth proofing of fabrics and insect proofing of leather^{8,9}. Parkin¹⁰, Butterfield *et al*¹¹ and Atkins and Greer¹², studied the effects of impregnating jute bags with DDT for storing grains. But, it was found unsuitable for storing flour because of the degree



of pesticide contamination at the effective levels of the insecticide. A considerable amount of data on the effects of impregnating jute sacking with DDT and BHC on the control of stored grain pests have been collected by Misra¹³, Haq *et al.*¹⁴, Dixit *et al.*¹⁵, and also reported in various reports¹⁶⁻¹⁹ of the Technical Development Laboratory, Kanpur. Ranganathan *et al.*²⁰, have made an interesting observation on the synergistic action of methyl anthraquinone on the action of DDT. Pingale²¹ also reported about the synergistic effect of sesame oil on the insecticidal activities of Lindane. The Indian Jute Mills Association Research Institute (IJMARI) has been engaged on the technological aspects of insect-proofing of sacking materials, such as the introduction of insecticidal chemicals in the batching emulsion and subsequent processing of the jute slivers into sacking weft, since 1947²². The IJMARI completed the preliminary trials of the insect-proofing process for introducing the treatment under jute mill conditions and reported in the 1959 report²³. Pingale²⁴ observed that Lindane (99.2 per cent BHC) was the most suitable insecticide for impregnating jute bags for rendering them insect-proof. Majumder and Pingale²⁵ studied the physico-chemical aspects of impregnating jute bags with Lindane in oil-in-water type emulsion. Jute fabric, B-twill type, exhibited considerable affinity for Lindane in oil-in-water emulsion and the preferential absorption of the insecticide by the bags in progressive dipping of bags in an emulsion bath resulted in the depletion of the concentration of Lindane from the dispersed phase. As a result of this phenomenon, the first few bags in the serial dipping absorbed maximum quantities of the insecticides and the subsequent bags in the serial dipping in the same bath received inadequate levels of insecticidal impregnation.

Majumder and Pingale²⁵, further studied the effects of presoaking of the B-twill fabric, mordanting with aluminium sulphate prior to dipping in Lindane emulsion bath and increasing the viscosity of continuous phase of the emulsion on the relative affinity for Lindane. Although agar was found to reduce the preferential absorption of Lindane by the fabric, the activity of insecticide was also reduced.

Pingale and Majumder²⁶, while screening through the residual chlorinated hydrocarbon insecticides (DDT, BHC, Lindane, Aldrin and Dieldrin) observed that the Lindane and Dieldrin combination was having the highest insecticidal activity on the stored grain pests *Sitophilus oryzae* (L), *Tribolium castaneum* (Hub), *Laetheticus oryzae* (Wat.), *Stegobium paniceum* (L), *Araecerus fasciculatus* (Deg.), *Rhizopertha dominica* (F.), *Trogoderma granaria* (Ev), and *Ephestia cautella* (Wlk). They reported that 35 mg. of Lindane and 35 mg. of Dieldrin per square foot of B-twill fabric could give adequate protection of wheat, rice, groundnut and dried tapioca chips from insect pests for a period of one year. Majumder²⁷⁻²⁸ studied the water uptake of different types of fabrics A-twill, B-twill D.W., Hessian and other sackings and reported about the optimum water and emulsion concentrate ratio for insect proofing different types of fabrics.

Misra¹⁸ reported that complete control of insect infestation was not possible by treatment of sacking alone. Muthu and Pingale²⁹ used ethylene dichloride-carbon tetrachloride (3:1) mixture, acrylonitrile, carbon tetrachloride, ethylene dibromide by injecting these fumigants in individual insect-proofed bags containing grain. Murthy *et al.*^{29a}, used methyl bromide fumigation of packaged walnut in insecticide-treated crates with good results. However, the water dispersible emulsion used for insect-proofing of the crates was found to have undesirable effects due to the increase in moisture in the timber of crates on large-scale application.

Majumder and Krishna Rao^{27, 30, 31}, have developed an oil based formulation of Lindane to spray directly on the bag stack surface as a prophylactic measure. Similar formulation containing high boiling petroleum fraction, batching oil, linseed oil and groundnut oil as carriers for Lindane and Dieldrin has been developed for spraying on gunny cloth, which has been utilized for covering bag stacks to prevent cross infestation. Excellent results have been obtained by the use of this prophylactic gunny cloth in combination with fumigation with a mixture of EDB and MB. There was no contamination through B-twill fabric if the oil based formulation having at least a viscosity of 145, sec. Redwood No. 1 at

25°C. was sprayed with a swirl type low volume nozzle at a pressure of 35 lb./sq. in. The degrees of contamination through various fabrics have been investigated, of the oilbased spray of Lindane and Lindane/Dieldrin. The results showed that the contamination hazard to the grain was only hypothetical in fabric having about 5 per cent weave-clearance. No contamination could be detected in the filter paper placed below the fabrics. In D.W. and in fabrics having 26-30 per cent weave clearances contamination levels in grains were much below permissible limits. Lindane estimated from the filter paper placed below the sprayed surface of fabrics indicated that the contamination of grains was below 0.2 p.p.m. in case of fabrics having 30 per cent weave clearance when sampled immediately after the spraying.

Recent experiments³⁰ at the Central Food Technological Research Institute, Mysore, have indicated the possibility of using activated clays, charcoals, silicagel dusts not only to maintain absorption and desorption equilibria of low boiling fumigants but also to exert direct insecticidal effects on the external surfaces of the grain bag stacks. The prophylactic actions of these active dusts in conjunction with fumigation with the efficient combination of fumigants containing chloropicrin, ethylene dibromide and methylbromide have yielded excellent results in laboratory scale storage of grains in experimental bags.

Studies on Fumigants

No prophylactic treatment will be effective until the materials stored inside the containers are free from initial infestation. The curative treatments like the fumigation and heat sterilization assume importance for enhancing the effects of prophylactic measures. Since mixing of inert dusts and active insecticidal powders offers difficult technological problems connected with mixing of solids with solids, in a scale as large as the size of harvest, thrashing and other practices of grain processing, the application of fumigants is becoming increasingly adaptable to conditions of grain storage, processing, transport and handling in India. The recent trend of research in the field is reviewed in the present

article on the context of evolving prophylactic treatments for pest control on stored foodstuffs.

Although the use of smoke and burning of sulphur for the control of insect pests in godowns are century old practices, the research in this field is of very recent origin in India. Coyne³², Pruthi and Singh³³, Sontakay³³ and Krishnamurthy and Seshagiri Rao³⁴ have reviewed the properties and use of fumigants for storage of foodgrains. However, the current interest on researches on fumigants seems to centre round the aspects of screening for relative efficacies, effects on different stages of life cycle of the pests and effects of the fumigants on the respiratory metabolism³⁵⁻⁴⁵. The effect of ethylene dichloride-carbon tetrachloride mixture on the life stages of *Sitophilus oryzae* (L), *Rhizopertha dominica* (F), *Trogoderma granaria* (Everts), *Tribolium castaneum* (Hub.) and *Corcyra cephalonica* (St.) were investigated by Muthu and Pingale⁴⁶. Pingale and Swaminathan⁴⁷ and Pingale and Muthu^{48, 49} reported on ethylene dibromide as a suitable fumigant under Indian conditions of storage. Ethyl bromide has also been investigated as a fumigant in India³⁹.

Bhambani and Rout⁵⁰ found carbon disulphide more toxic than carbon tetrachloride, EDCT and ethylene dichloride. EDCT and Carbon tetrachloride were reported to give better mortalities than EDB under the experimental conditions. Kundu⁵¹ found that methyl bromide adversely affected the water balance of the larvae of *Tenebrio molitor* and caused death. Srivastava⁵⁰ tested the efficacy of carbon tetrachloride, EDCT, carbon tetrachloride and EDB mixture (95 per cent+5 per cent), EDB, and ethylene dichloride at dosages of 10, 20, 8, 3 and 30 lb./1000 c.ft. respectively for 24 hours against *Stegobium paniceum* (L) infesting turmeric in Rajasthan, and found that the carbon tetrachloride and EDB mixture was the most toxic of the fumigants and combination of fumigants tested. Pradhan and Bhatia⁵¹, found the mortality of the insects due to HCN fumigation either depended upon the ability of the insects to resist penetration of the fumigant into the system or the capacity to reduce the toxic effects of HCN. Seshagiri Rao⁵² reported the use of 'Cyanogas' dust as

a fumigant for food grains. He has also studied the possibility of giving heat treatment⁵³ to godowns for pest control.

Majumder *et al.*^{54, 55} studied the effects of ethylene dibromide and methyl bromide on the microflora and pests of *jowar* (*Andropogon sorghum*) and milled rice. The effects of ethylene dibromide, ethyl bromide, methyl bromide, formaldehyde on the storage of moist tapioca (*Manihot utilisima*) chips and tubers were studied by Majumder *et al.*⁵⁵⁻⁵⁷. Desikachar *et al.*⁵⁸ studied the effects of chlorine on the microflora of paddy.

Kadkol *et al.*⁵⁹ have reported that the biological value of the proteins in rice and groundnut was not significantly decreased as a result of fumigation with methyl bromide at the rate of 2 lb./1000 c.ft. for 24 hours at 70-80°F. The fumigant residues of ethylene dibromide, methyl bromide have been reported by Majumder *et al.*^{54, 55, 60, 61}, Muthu *et al.*²⁹ and Pingale *et al.*^{49, 62}.

In the matter of the application of fumigants, various techniques have been developed to increase efficiency. The more important of them are: (i) Recirculation or forced circulation of the fumigant by using centrifugal fans as developed in Germany Switzerland and other Continental countries and later adopted in U.S.A. and U.K.^{63, 64} and (ii) Reduced pressure or vacuum fumigation in vaults using methyl bromide, hydrogen cyanide or ethylene oxide for achieving better and quick penetration into tightly packed commodities⁶⁴⁻⁶⁵.

A modified vacuum technique of fumigation which hinges around the idea of making use of residual fumigant left inside fumatoria, for subsequent fumigations by recirculating the same has been developed^{27, 30, 57}. An initial dosage of 32 mg. l. of methyl bromide can be reused for a total of three serial fumigations with 3, 6 and 18 hours exposures to obtain the required C×T product. Economy in the fumigant with the other advantages of vacuum fumigation are the salient features of this technique. Use of insect-proof packages in conjunction with the serial fumigation treatment ensures prophylaxis against insect pests.

Work on general purpose fumigants for godowns and warehouses in India has generally been on the use of EDCT, EDB and HCN. How-

ever, incomplete insect mortalities due to low toxicity, high sorption and low penetration of the fumigants into bulk commodities, have been the bane of pest control workers⁶⁵. Recent work⁶⁹ has shown that a combination of MB with EDB provides the answer to these failings, while EDB due to its low penetrability and high⁶⁸ sorption and EDCT due to its low toxicity require longer exposures and larger dosages.^{46, 70}

Muthu and Majumder^{27, 30, 31, 69} studied the startification and adsorption of MB and EDB combination in grain columns and bag stacks. They observed that the incubated samples of treated grain show incomplete larval mortality of *Sitophilus oryzae* with EDB alone. EDB (48 mg./litre) required 48 hours to build up a toxic concentration at the bottom of a 5 ft. column of grain (*jowar*, 13 per cent moisture and 85°F), whereas MB showed a toxic concentration in 5 hours with a lower dosage (32 mg./litre). A combination of both EDB and MB in proportion of 1:1.6 and dosed at the rate of 32 mgm/litre in treating a stock of enriched wheat-flour in polyethylene-lined jute bags has given very good penetration factors. Lower concentrations of MB in EDB (0.5:1, 0.25:1, W/W) have also proved efficient in fumigating grain bags in air-tight godowns and under gas-proof tents. The fumigant residue of the combination was found to be lower in the foodstuffs than when either of them were used at their effective levels. In conjunction with the insect-proofing treatments of the grain bags and bag stacks, the fumigant combination enhanced the efficacy of the prophylactic treatment for grain storage.

Studies on Hermetic Storage and Structural Prophylaxis

Storage of grains in underground pits, *Khattis* and other indigenous underground and above ground structures is the age old practice in India and other tropical parts of the world. The principle of *air-tight* storage has been utilized here. At the Pest Infestation Laboratory, U.K., considerable amount of data are being collected on hermetic storage of grains. Although, the insect infestation is prevented under hermetic conditions as a result of depletion of oxygen and increase in the carbon dioxide tension in the

environment of the structure, the microbiological activities in the bulk stored grain constitute a major factor for the deterioration of grains. There is no reliable information on the critical moisture level that could be used as a guide for drying the grain prior to storage in bulk. The safe moisture levels for hermetic storage of *jowar* (*Andropogon sorghum*) and coffee beans were reported to be below 13 per cent and 9 per cent respectively.^{71, 72, 27, 30} Pingale *et al.*⁷³ studied the effects of different structures on the air-tight storage of grains and concluded that the indigenous earthen structures due to their low thermal conductivity and high moisture sorption capacity were beneficial for storage of grains especially under wide fluctuations of atmospheric temperatures. The large-scale trial on the applicability of the principles of elevator storage of grains is in progress at Hapur in India, to yield data under the tropical conditions and wide temperature fluctuations.

Recent studies of Majumder *et al.*^{56, 54} and Srinivasan and Majumder^{50, 74} at the Central Food Technological Research Institute have shown the possibilities of sterilizing a bulk grain containing high moisture levels with methyl bromide, chlorpicrin, ethylene oxide and ethylene dibromide-chlorpicrin and storage of the moist grains under hermetic conditions. This line of study may yield results making it possible even to offset the adverse effects of diurnal changes on the grains stored in metal structures of high thermal conductivities and the high moisture locales in bulk grain. Studies carried out on the air-tight storage of coffee have shown that a polyethylene 'balloon' of 300 gauge could be used for storage of coffee beans under high humid conditions to prevent the development of the condition known as 'monsooned' ^{71, 72}. Large-scale trials are in progress on the 'Ballooning technique' for storage of coffee beans in the high humid coastal zone.

Another approach on the research on *prophylactic* storage treatments for food articles, is the screening of repellents for insects and rodents. Krishnakumari^{27, 23} while screening through different inorganic and organic chemicals observed that quinine hydrochloride when used on kraft

paper bags resulted in an attractant effect for *Rattus rattus*. She also observed that clove oil, malathion and lime sulphur exhibited rodent repellent properties³⁰.

Studies on the Pesticidal Contamination of Foodstuffs

The toxicological and public health aspects of the pesticidal treatments have attracted attention of research workers in India.^{75, 76} Pradhan⁷⁷ and Pradhan and Bhatia^{51, 78}, have been developing bioassay techniques for the spray deposits of insecticides. Majumder and Pingale^{79, 81}, Pingale and Majumder^{82, 83}, Majumder *et al.*^{75, 80}, Pingale *et al.*^{82, 84}, Majumder and Srinivasan⁸⁵ Krishnamurthy *et al.*⁸⁶, and Mitra *et al.*⁸⁷ studied the various aspects of pesticide analysis and residues of insecticides in foods.

The Central Committee of Food Standards under the Ministry of Health are working on the fixation of permissible limits of pesticidal contaminations in food articles in India.

Future Lines of Work

There is no doubt that the treatments, however effective, should not be applied to foodstuffs directly if the toxic residues are left in them. Therefore direct mixing of insecticides, at least the residual ones, is not desirable for the reasons of public health. Development of prophylactic processes keeping in view, the pharmacological and toxicological aspects of both acute and chronic toxicities, will be the best practical approach for insect pest control. Sterilization of food grains with radiations, impact treatment of milled articles in entoletors, ultrasonic vibrations and even fumigants are the curative treatments. If these treatments are employed along with the prophylactic treatment like the insect-proof packages, containers and structures, long term storage of foodstuffs can be effected without endangering the health of the consumers.

There seems to be a need to stimulate and initiate research for developing the prophylactic treatments for storage of foodgrains and processed foods. The field of specific toxicity of the pathogenic microorganisms⁸⁸⁻⁹⁰ is endowed with vast possibilities. Research on the vulnerable and specific metabolic pathway connected

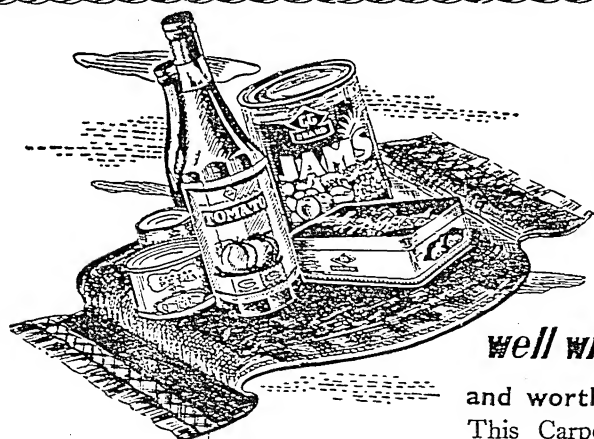
with the development of their life cycles and metamorphosis⁹¹⁻⁹³, the use of radio-isotopes, activated dusts⁷, specific antibiotics and the development of insect repellents are the profitable

lines of research for developing prophylactic methods for storage of foodgrains, macaroni products, confectioneries, dehydrated meat, fish, eggs, vegetables and other articles of food.

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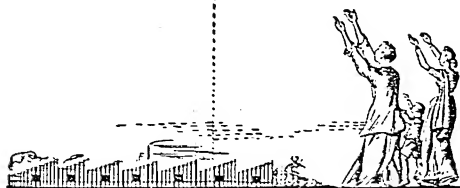
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A G R A



Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during January–February 1960 are given in this section.

S (IS) 7

Principles of Durofume process, by S. K. Majumder (January 18, 1960).—The common occurrence of field infestation in harvested grains and ubiquitous distribution of stored grain pests in the tropics have necessitated development of a prophylactic process for grain disinfection as well as prevention of cross infestation during storage of grain in bags under warehousing conditions. The speaker presented the data on the comparative physico-chemical and insecticidal properties of ammonia, sulphur dioxide, hydrocyanic acid, acrylonitrile, carbon disulphide, carbon tetrachloride, chloroform, chloropicrin, ethylene dichloride, ethylene dibromide, ethylene oxide, methyl bromide and ethyl bromide. Commercial suitability of the probable practical fumigant combinations such as ED/CT, EDB/CT and MB/EDB was discussed in the light of the results obtained with reference to the following: (1) LD₅₀ values for insect pests (2) commercial dosages under warehouse condition, (3) penetrability in bulk grain, (4) residues on cereals, pulses spices, oilseeds, milled products, groundnut, copra and cashewnut, (5) exposure periods, (6) operational safety and (7) cost. The speaker then pointed out that MB-EDB combinations were the cheapest and the best for disinfection of grains under warehouse conditions, because in addition to the above factors, eggs, larvae, pupae and adults of test insects could be killed with this combination.

Shri Majumder then described the experiments carried out on the stratification of EDB and MB used singly and in combination in loaded fumigation columns and grain bag stacks. He observed that due to

high sorption of ethylene dibromide at the top layers of grain columns, adequate time-concentration product could not be obtained at the bottom layers within the exposure period of 48 hours. As compared to methyl bromide, the diffusion of ethylene dibromide through 5 ft. columns of wheat semolina, sound as well as infested wheat and jowar was found to be very low. But the tendency of methyl bromide to stratify too quickly towards the bottom, caused incomplete mortality of *Tribolium castaneum* adults exposed at the top layers of the grain column. With a dosage of 32 mg. per litre of 1:1 EDB and MB combination, uniform concentration of the fumigant mixture was obtained even in packed semolina columns and columns of grains having high dockage. Total mortalities of test *T. castaneum* adults were obtained at all strata of the fumigation column.

Continuing, the speaker presented the data regarding the fumigant residues on jowar, groundnut and cashewnut with EDB, MB and EDB-MB combination at 1, 2 and 4 lb. dosages per 1000 cubic feet of materials. At the effective dosage of EDB, 8, 21, and 72 p.p.m. of bromide residues were obtained on jowar, groundnut and cashewnut respectively while the corresponding figures for methylbromide were 12, 26 and 65 p.p.m. In contrast with this, EDB-MB combination at the effective dosage of 2 lb./1000 cubic ft. and 48 hours exposure period, resulted in the least amounts of residues on jowar, groundnut and cashewnut. The toxicological significance of the fumigant residues on the food articles rich in carbohydrates, proteins and fats was discussed on the basis of the present day knowledge on the subject. It

was observed that the residues of EDB were related to the fat contents of foodstuffs while the MB residues were more related to the protein contents of foodstuffs.

After describing the experiments carried out on the curative process of fumigation for disinfection of foodgrains, Shri Majumder narrated the results of the experiments on developing a prophylactic treatment for preventing reinfestation or cross infestation of the fumigated grain bag stack.

The speaker presented the data obtained on the various aspects of the problem of insect-proofing of grain bag stack with an oil-base formulation. The formulations based on (i) Lindane, (ii) Lindane and Dieldrin, and (iii) DDT, BHC and Malathion were described and the application techniques for the different compositions were dealt with in detail. With reference to the infiltration time required for *T. castaneum* and *Calandra oryzae* adults to pass through different fabrics such as A-twill, B-twill, D.W., Heavy cees and Hessian, the dosage requirements for insect-proofing of these were elaborated by the speaker. Data obtained on the effects of some fixed oils on the residual life and insecticidal toxicities of BHC, DDT and Malathion were then presented. The speaker pointed out that on the basis of the LD₅₀ values for *T. castaneum* adults the synergistic effects of vegetable oils could be demonstrated. He said that there seemed to be some relationship of the degree of saturation of the vegetable oils with the insecticidal potencies of DDT, BHC and Malathion. Marked increase in the persistence of insecticides on treated surfaces and considerable enhancement of pesticidal potencies due to the incorporation

of groundnut oil in the oil-base formulation, indicated the possibility of using insecticide at lower levels, for the preparation of insect-proof prophylactic cloth. He described in detail the implications of the pesticidal contaminations of food-stuffs, permissible limits, and the effect of drop size ranges on the degree of contamination through different weave clearances of the sacking fabrics. Effects of dust deposit on the persistence and biological (insecticidal) effectiveness of insecticide on treated glass surface were described in the light of practical conditions in warehouses.

The speaker also indicated the possibility of the revivification of biological effectiveness of the insecticidal deposit covered with dust particles with simple vegetable oil spraying at a level of 0.2–0.3 ml. per sq. ft. He gave an account of the work now in progress, on the use of insecticidal activated clays, charcoal and silicagel for use on grain-bag stack for preventing reinfestation by migratory pests and indicated the future plan of work.

The discussion that followed covered points relating to physico-chemical and toxicological aspects, organoleptic qualities of food articles fumigated with methyl bromide, removal of dead insects from fumigated foodstuffs, relationship of the degree of saturation of oils with the insecticidal effectiveness, etc.

Concluding, the President suggested that more and more fumigant combinations should be tried and stress should be laid on using fumigants having less difference in boiling points. He also said that efforts should be made to develop newer techniques for dispersing fumigants in grain bulk.

S (IS) 8

Studies on the determination of the degree of polishing in rice, by H. S. R. Desikachar (February 5, 1960).—After referring to the work carried out earlier on the subject in this Institute, the speaker stated that the work was resumed again as the Directorate of Storage and Inspection, Ministry of Food, Government of India,

wanted further information on the subject with a view to developing a simple and rapid method of ascertaining the degree of polishing in rice. The significance of the term 'Degree of Polishing' and methods of expressing it were first pointed out.

In ten different varieties of rice obtained from Mysore, Andhra and Madhya Pradesh States and polished to known degrees of polishing, the percentage losses in phosphorus content, yellow colour developed with alkaline methanol, red colour developed with concentrated sulphuric acid as well as the percentage loss of germs were determined. The whiteness as well as the percentage loss in average kernel weight during polishing were also determined in these samples. There was a progressive increase or decrease of these constituents in each variety of rice but the rate of increase or decrease was not the same for all varieties. Hence a single absolute standard could not be fixed for all varieties. Moreover, in view of the varietal differences in composition of the rice varieties, the hulled rice from the variety was always needed for comparison. It was stated that the measurement of the percentage loss in average kernel weight and the whiteness of the rice grain as measured in a reflectance meter holds promise of being developed as field methods for testing, as they are simple and quick. There was good correlation between the degree of polishing and the percentage loss in average kernel weight.

It was pointed out that in practical rice milling it would be difficult to polish rice so as to remove a definite weight of the grain in the form of bran, i.e., to obtain rice of a specified degree of polishing expressed in terms of percentage bran removed. It would be easier to mill rice so as to obtain a product resembling in whiteness a standard reference sample. If rice milling is to be enforced, standard samples of approved degree of milling in different varieties could be made available to rice mills to act as

reference standards. The actual degree of polishing in milled samples could then be assessed quantitatively by laboratory tests.

The results of studies to determine the variation in the degree of polishing of individual grains at different stages of polishing were next described. It was pointed out that all the rice grains did not undergo polishing to the same degree as could be visually noticed by examining polished rice samples in the coloured varieties of rice. Using such a coloured variety of rice, the amount of residual bran on single grains was measured by extracting it with boiling 2 per cent sodium carbonate solution and measuring the intensity of the red pigment in the solution. Wide variations were noticed in the degree of polishing of individual grains. The spread of the histogram curves was reduced with increase in the degree of polishing.

The talk was followed by a discussion in which the points raised related to the distinction between the two terms milling and polishing, varietal variations in chemical composition which limit the formulation of a single yardstick, measurement of colour extracted from the rice samples, the ash content of rice as a measure of its degree of polishing, the effect of different types of milling machines on the degree of polishing, the feasibility of restricting the degree of polishing in rice, storage quality, nutritive value and consumer acceptability of under-polished rice, etc.

The President in his concluding remarks referred to the very difficult nature of the problem. In view of the very large number of commercial samples and variation in chemical composition and moisture content of market varieties, it would be very difficult to develop one single criterion based on which the Government can enforce its laws. He suggested that the Government can consider the possibility of purchasing unpolished rice from the merchants and polishing it later in a central mill located in their store-houses.

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Extraction of lime oil

E (IS) 19

I want to try and extract oil and scent from limes which are plentiful here in this season. I shall be obliged if you will kindly suggest a simple process by which I can do this. Also let me know as to what should be done with the lime juice. (Bhavnagar)

We presume that you are interested in the extraction of lime oil and not lemon oil as you have stated in your letter. For a small scale unit, you will need Ecuelle disc made of either aluminium or stainless steel which can be had for a sum of Rs 120—300 either from

Messrs Gardners Corporation,
Connaught Circus,
New Delhi,

or

Messrs Raylon Metal Works,
293, Bellasis Road, Bombay-8.

For extraction of juice, you will need about a dozen hand juice extractors made of either wood, aluminium or stainless steel. These can be had from any provision or cutlery stores. For filtration of the juice to remove all seeds, you can use aluminium or stainless steel sieves. All the above equipment can be had from the above mentioned two firms. The process of extraction is as follows:

Ecuelle disc has spikes which have blunt ends. The limes are rolled over smoothly so as to extract oil. Later the limes are cut into halves and the juice extracted. 5 per cent salt is added to the oil after extraction and it is allowed to settle for 3-4 hours. Further, oil which comes out in the top layer is scooped out and passed through wool or flannel. The filtered oil can be

preserved with NDGA which can be had from any branch of Imperial Chemical Industries (India) Ltd., or the British Drug Houses (India) Private Ltd. The juice which is extracted is later on passed through the sieve for removal of the seeds. The juice can be preserved in wooden barrels which are lined with wax from inside by addition of about two ounces of potassium metabisulphite for 100 pounds of the juice. This juice can be supplied to the firms making squashes and other products. You can also prepare squash or cordial from the above juice and market it after taking the necessary licence from the Agricultural Marketing Adviser to the Government of India, New Secretariat Buildings, Nagpur.

Preparation of bread

E (IS) 20

I should be thankful if you could give me a correct recipe for making bread at home. Bakers refuse to disclose how it is done and by following the instructions on the tins of baker's yeast, one does not get the soft spongy bread that the bakers sell. (Madras)

We might suggest the following recipe for making bread at home:

Fluid milk ...	... 2 cups
Baker's yeast ...	... 1% of flour or as given on yeast container
Water ...	... $\frac{1}{2}$ cup
Sugar ...	... 2 tablespoons
Fat ...	... 2 tablespoons
Flour ...	... 6 cups
Size of pan ...	... $9 \times 5 \times 3$ "
Temperature ...	... 400°F
Baking time ...	... 45-50 minutes

Procedure: Soften yeast in luke warm water at 85°F. for 5-10 minutes. Measure sugar, salt, and fat into a mixing bowl. Add hot

milk until sugar and salt are dissolved and the fat is melted. When milk is luke warm, say at 80°F., add the softened yeast. Add half of flour to the mixture and beat vigorously with spoon. Add enough more flour to make a soft dough adding half cup at a time. Knead the dough properly. Grease the dough with melted fat and let it rise until the dough doubles. The rising time may vary from 1-3 hours depending upon the temperature and the amount of yeast and type of dough. Punch down the dough to remove gas. Then bread may be allowed to rise again if necessary. Make portions of the dough and allow to rest for 10 minutes. Shape it into loaves. Roll each portion of the dough into a rectangle about 15" long and 9" wide. Fold $\frac{1}{3}$ of the dough lengthwise on the folded edge, press firmly from the centre towards the ends to remove any trapped air and then fold the other third of the long side over and seal the same as the first fold. Overlap the ends of the folded dough so that the loaf is slightly shorter than the bread pan. Press out any trapped air, fold the dough lengthwise and seal. Again allow it to rise to 85°F. till double the bulk is formed. Bake between 375-400°F. for 30-35 minutes, then remove from the pans immediately and cool it.

The reasons for the bread made at home not having spongy and soft structure are numerous. For example, in the making of bread, a proper balance of the constituents of the flour is an important factor. Any slight variations in it will cause the quality of the bread to be lowered. The bakers who are doing this process see to the effect that the balance is maintained. The important constituents

of the flour are starch, proteins, fat, sugar, mineral salts, moisture and a little of cellulose. Even the making of dough is very important and any wrong process followed in the making of dough such as too much water or improper temperature control is bound to result in poor quality. Action of the yeast is another aspect in the making of good quality bread. In the fermentation process, temperature of 74-76° F. results in bread possessing moistness, flavour and also good crumb colour. It should also be observed that the longer the process of fermentation the lower should be the temperature.

While preparing bread at home, it is very difficult to keep a control over all these factors and hence the quality of the bread made at home does not have any comparison with that of the bread made by the bakers.

Preservation of lemon juice

E (IS) 21

I have tried to preserve lemon juice by the addition of sugar to the juice but the product gets spoiled very soon. I shall be grateful if you can kindly advise me on the correct approach to be made to avoid spoilage. (Guntur District).

We should like to point out that the lemon juice preserved as such or with little addition of sugar is bound to spoil. We do not know the exact proportion of sugar you added but we assume it must have been less. For preservation of juice with sugar, the percentage of sugar should be minimum 65 which means roughly in the proportion of one part of juice to two parts of sugar. When the proportion of sugar is reduced, the juice can be preserved by addition of preservatives such as potassium metabisulphite or sodium benzoate in the proportion of 1 oz. of potassium metabisulphite per 100 lb. of the juice or sugar mixture known as squash or 1½ oz. of sodium benzoate for 100 lb. of the squash. The lemon juice can also itself be

preserved without addition of any sugar by the use of the above two mentioned preservatives. Such lemon juice is stored by addition of either 2½ oz. of potassium metabisulphite or 1½ times its quantity of sodium benzoate for 100 lb. of juice. This juice is later on used for making squash, cordial or syrup. In the squash or cordial, the proportion of preservative allowed under Fruit Products Order is either 350 parts of potassium metabisulphite (1 oz. for 100 lb. of the squash) or 600 parts of sodium benzoate (1½ oz. per 100 lb. of squash).

Sourness and colour of cherries

E (IS) 22

We shall be extremely thankful to you if you can let us know some method by which the sourness of cherries can be minimised before the fruits are processed into products. Another difficulty we find is that the colour of cherries fades to some extent after processing. Please suggest a suitable colour that we can use to obviate this defect. (Bombay)

The sourness of the cherries can be removed to some extent by bleaching process, i.e., soaking in water containing very little quantity of potassium metabisulphite for several hours with frequent changes of water or treatment with a mild alkali such as sodium bicarbonate. As regards colour of cherries, edicol erythrosene is the only colour which will not fade but this colour is still not permitted by the Fruit Products Order. Other combinations of colours such as of carmoisine and ponceau in equal proportions are

also not very satisfactory, but can be tried.

Removal of skin in ginger

E (IS) 23

Could you suggest us any easy method by which the outer skin of fresh ginger and the fibre portion can be removed before its use for processing? (Bombay)

As regards removal of the outer skin of the fresh ginger, the only way is to scrape the ginger in fresh condition with scrapers made out of either conch shell or bamboo. Electrically operated potato peeler is not very useful because of the odd shape and size of the ginger and it also gets injured during the peeling operation. Another way by which the skin is removed is to soak the ginger and then rub it on gunny bags so that the skin loosened. But this is also not an efficient method. It is not possible to remove the fibre from the ginger. The only way to avoid it is to use fibreless variety of ginger such as the China type which is grown extensively in Himachal Pradesh.

Chilli sauce

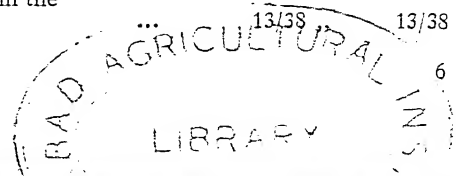
E (IS) 24

Please let us have particulars of the method of preparation and formula of chilli sauce. (Secunderabad)

Chilli sauce is a cooked product made from chopped peeled ripe tomatoes, chopped pepper, salt, sugar, spices and vinegar with or without onions and garlic. The tomatoes used for the purpose can be either freshly peeled, canned tomatoes or peeled tomatoes with added pulp.

RECIPE FOR CHILLI SAUCE

	"A"		"B"	
Peeled tomatoes	... 330	lb.	270	lb.
Sugar	... 22½	"	17	" 3 oz.
Salt	... 5	"	3	" 12 "
Onions (peeled and chopped)	... 6½	"	6½	"
Vinegar (100 grain)—white distilled	... 10	"	10	"
Garlic (peeled and chopped fine)	...	½ oz.	...	½ oz.
Cayenne pepper	...	1½ oz.	...	1½ "
Mace	...	"	...	"
Cinnamon	...	2½ "	...	2½ "
Celery seeds	...	2½ "	...	"
Essential oils (combination of oil of pimento and oil of clove in the proportion of 1:2)	...	"	...	"



In making of the 'B' type sauce, add 4 oz. of yellow mustard seed in addition to the above spices.

Procedure: Add about half of the tomatoes to the cooking tank and cover with 6-7 lb. of sugar. Then add about 20-25 lb. more of tomatoes and turn on the steam. Scatter the cayenne over the tomatoes and add the spice bag. As the batch cooks down gradually, add more tomatoes so as not to stop the boiling and after all the tomatoes have been added and concentrated to about half the volume, add the balance of the sugar and cook to below the finishing point. The finishing point is attained when the contents are about 17½-18 gallons. Then add the salt and finally the vinegar. Instead of vinegar, glacial acetic acid can be added. In that case the quantity of acetic acid will be reduced depending upon the strength of the acid. If vinegar is added, it should be cooked in the batch several minutes to get rid of the raw flavour. When finishing, the blended oil is scattered over the surface, steam is then turned on for about five seconds in order to mix. Then fill into bottles at 190°F. If necessary, you can add sodium benzoate in small quantity. The bottles can be further sterilised at 190°F. for 30 minutes. It should be remembered that all the spices except cayenne should be placed in a bag which is to be immersed when the cooking operation starts.

Spoilage in canned products

E (IS) 25

We find from our experience that canned vegetable products puff within a week's time of their canning while in fruits, swelling is noticed after six months. Among fruits, we find more trouble with products like cherries. Will you kindly enlighten us as to the possible reasons for these defects? (Bombay)

As a normal rule, if all the processing conditions are adequately maintained such as quality of raw material, general sanitation, proper seaming, careful processing (proper pressure, absence of air pockets,

thermometer and pressure gauge being in good condition), proper cooling in clean water free from contamination, etc., there is no room for spoilage for more than 1/4 to 1/2 per cent.

Fruits or other acidic products do not spoil easily unless the acidity is so high as to create hydrogen swells or the tin plate is defective or the temperature of storage is very high. This could also happen if the head space maintained is too small. If all these factors are properly controlled, spoilage should not occur for a period of approximately one year. In the case of cherries, exhausting also becomes difficult because of the fact that they are canned with pits and therefore the centre temperature does not increase easily. It may also be noted that the spoilage mentioned in the case of cherries and other similar fruits should not be mistaken for hydrogen swells always. We suggest that you may kindly consult the can manufacturers for suitable lacquer lining required for cans used for cherries.

Discolouration in canned peaches

E (IS) 26

We were using only Peshawari peaches for canning and had no trouble in canning them. Recently due to import restrictions, we are forced to use the Indian variety and we find that the canned product turns black after some time. We shall be grateful if you could suggest a method to overcome this. (Bombay)

There are only certain varieties of this fruit which are suitable for canning. The varieties which are grown at present in the Kumaon Hills are not quite suitable for this purpose and therefore turn dark brown on storage of cans. The presence of alkali from lye peeling can also cause browning of peaches. It is very essential to wash the alkali carefully and neutralize it. If the fruit is not cooled immediately and properly after processing, the chemical reaction continuous at higher temperature resulting in browning.

Leak-proof closures for pickle bottles

E (IS) 27

We are eager to market our quality pickles in bottles for sale in Indian and foreign markets but are unable to do the same in the absence of reasonably priced leak-proof closures. Could you kindly advice us in the matter? (Bombay)

The leaking is due many a time to unevenness of the neck and the groove of the bottle with the result that some closures do not fit tightly to the bottles. At present, we are not carrying out any work on this subject and hence regret our inability to advise you on any specific leak-proof closure. You might try the R.O. seal caps with rubber lining inside as this might help to some extent or you might also try to seal the entire mouth of the bottle with cork and dip the mouth of the bottle in molten wax. For preparing the wax, you may use a combination of paraffin wax and micro-crystalline wax in the proportion of 4:1. In addition use either metal or bakelite cap.

Uses of cashew shell oil

E (IS) 28

We shall be much obliged if you kindly enlighten us on the general and medicinal uses of cashew shell oil. (Nagapattinam)

We give below the information desired by you on cashew shell oil:

The shell oil which is highly acrid and corrosive due to the presence of the phenolic compound 'cardol' and anacardic acid is an important by-product of this cashew industry. It is used in medicinal preparations for the removal of warts and corns. Due to its antiseptic properties, it is used in the treatment of fishing nets, as a preservative for wood, for painting the keel of ships and for anti-mosquito measures. During recent years, shell oil is finding wide application in plastics, in the manufacture of indelible inks, water proofing compositions, for painting cement surfaces, etc. America is the chief buyer of the oil from India.

Notes and News

STATISTICAL NOTES

Production figures during the year 1959

Months	Biscuit		Confectionery		Flour milling		Aerated water		Butter		Gram flour and dal		Cashew-nut		Beer		Country spirit		Indian mac foreign liquor	
	Production (Tons)	No. of units reported	Production (Tons)	No. of units reported	Production (Tons)	No. of units reported	Production (Gross bottles)	No. of units reported	Production (Tons)	No. of units reported	Production (Tons)	No. of units reported	Production (Tons)	No. of units reported	Production (Bulk gallons)	No. of units reported	Production (L.P. gallons)	No. of units reported	Production (Bulk gallons)	No. of units reported
January	1,494	34	1,034	36	82,001	55	46,507	35	172	7	388	1	900	10	159,108	2	431,968	22	65,307	2
February	1,322	33	1,011	37	83,252	54	49,943	35	120	7	257	1	1,174	10	156,866	2	402,376	24	43,759	2
March	1,313	33	1,071	37	92,991	54	86,098	36	115	7	366	1	1,415	10	206,089	2	449,084	25	44,642	2
April	1,324	33	973	37	76,426	55	123,815	36	102	7	518	1	1,408	10	207,517	2	386,525	23	42,197	2
May	1,500	33	916	37	67,755	56	142,887	36	59	6	752	2	1,352	10	221,446	2	353,034	24	29,937	2
June	1,632	33	930	37	76,057	58	111,418	36	76	6	315	2	1,400	10	193,471	2	354,208	21	38,591	2
July	1,821	33	934	38	73,782	57	80,722	36	72	6	365	1	1,551	9	188,407	2	413,900	23	27,029	2
August	1,842	33	1,061	38	76,679	58	79,136	36	104	6	340	1	1,386	9	139,232	2	211,203	19	47,964	2
Sept.	1,858	33	1,243	37	80,673	58	82,476	36	152	6	354	1	936	10	94,557	2	391,160	22	65,351	2
October	1,764	32	1,229	36	85,253	57	91,693	36	150	5	394	1	1,177	9	172,375	2	344,737	22	41,711	1
Nove.	1,955	32	1,317	36	78,931	57	68,299	36	200	5	449	1	1,266	10	125,282	2	317,043	21	36,175	1
Dec.	1,927	32	1,619	36	86,147	57	63,222	36	245	5	388	1	914	10	129,170	2	354,474	18	34,178	1
Total	19,752		13,338		959,947		1,026,216		1,567		4,886		14,879		1,993,520		4,409,712		516,841	

(Ministry of Commerce and Industry, Government of India, New Delhi)

NEWS BRIEFS

New dry fondant: A new dry fondant, which requires only the addition of water for reconstruction was recently introduced by Tate and Lyle, Ltd., London, called *Drifon*. *Drifon*, produced by a special process, is composed of 90 per cent sucrose, 5 per cent levulose and 5 per cent dextrose, and resembles a dry, soft milled sugar. In processing, fine sucrose particles are mixed with a highly saturated cooked liquor containing sucrose, dextrose and levulose, which is then dehydrated. When reconstituted with water the result is a creamy fondant.

A leaflet issued by Tate and Lyle Ltd., lists some of the advantages offered by *Drifon*. These include: Ease of storage; simplified preparation; the product is dry, free running, and can be poured straight from bag to mixer; it combines rapidly with dairy products, fats, chocolate, fresh fruit juices, flavours and colours; and it is economical (*Food Technol. Austr.*, October 1959, p. 575).

Dehydrated baby foods: The Birds Eye Division of the General Foods Corporation has recently test-marketed a new line of baby foods at Watertown, a small town near New York. Using dehydro-

freezing as the process, these baby foods have been reduced to a dry powder which is being sold in laminated paper aluminium pouches. The baby food line includes meat, vegetables, fruits and desserts. Each pouch, when re-hydrated, makes one meal. There are 17 items in the new line, such as apple sauce, apples and apricots, pears and apples, vegetables (including green beans and potatoes, creamed spinach and peas), vegetables with bacon, chicken with vegetables.

The cartons of dehydrated baby foods are frozen after packing and kept at low temperature. In Watertown they are sold from frozen

food cases. Consumers are told that this baby food may be kept indefinitely in cold storage or as long as a month in a refrigerator at above-freezing temperatures. The cartons do not need to be thawed before using.

The biggest selling points being used by Birds Eye are nutrition and convenience and it is claimed that the new dehydrofreezing process is able to retain more of the natural food values (*Food Technol. Austr.*, October 1959, p. 579).

Proteins from vegetable material: The proteins found in vegetable material, particularly grasses and leaves, are not available as human food as they are bound with the cell structure. A process has been recently developed by British Glues and Chemicals Ltd. for the separation of protein from vegetable sources. The process known as 'impulse process' depends upon the breaking down of cellular vegetable matter suspended in a very weak alkaline solution by a series of shock waves of sufficient intensity and frequency produced by a series of mechanical beaters. The released proteins remain dissolved in the solution from which the insoluble carbohydrates and fibre are removed. Any oil present is separated from the protein-bearing solution. Thereafter, the protein is precipitated by neutralization and separated by centrifugation. The protein still contains a number of other components such as chlorophyll, sterols, hormones and vitamins, which are finally extracted with organic solvents in the form of a syrup. The extraction of protein is being undertaken on a half-size pilot plant scale. The same industrial plant is utilized for oil-bearing seeds as well (*Abstracted from Food*, November 1959, p. 422).

Instant food powders: A new process called 'foam-mat' drying, for converting foods into high-quality instant food powders has been developed. It involves whipping liquid food concentrates into a foam with the assistance of food additives, spreading the foam on a

belt or tray, drying it in a stream of warm air, and, finally, compressing and crushing it into powder form. The process has been used to make powders of good colour and flavour from fruit juice, whole and non-fat milk, coffee, beef and chicken broth, and lemonade.

The fine structure of the foam created in the process is said to remain stable even when the dried form is compressed into pellets, so that the powders can be reconstituted readily with water. The foam-dried powders also are said to have the advantage of holding less moisture at a given relative humidity than spray-dried foods (such as ordinary powdered coffee) and, therefore, are less apt to cake than powders dried by other processes.

The amount of food additive needed to develop a satisfactory foam is reported to be equal to about 1 per cent of the dry solids in the concentrate being whipped, and close control of foam density can be provided by careful adjustment of the quantity of additive and the amount of whipping (*Food*, November 1959, p. 441).

H₂O₂ as whey preservative: Bacterial growth in cheese whey may be inhibited for as much as 10 days without injury to the product by addition of 0.02 per cent H₂O₂. Then remaining traces of peroxide are easily removed by enzymatic action of catalase. This leaves the whey susceptible to microbiological attack.

Experiments with grossly contaminated cottage cheese whey showed a 97 per cent bacterial kill in 1 hour after addition of the peroxide (100 per cent kill required 16 hours exposure at 0.05 per cent H₂O₂ however) (*Food Engng.*, September 1959, p. 97).

Status of irradiation as food preservative: Work on radiation of foods has been concerned largely with finding out which items are acceptable organoleptically following sterilization or pasteurization. Off-flavours following sterilization are virtually non-existent in oysters, shrimp, chicken and pork. Beef

and dairy products, on the other hand, usually develop strong off-flavours. However, certain materials found in tomatoes will control off-flavour in beef, and concurrent radiation and vacuum deodorization shows promise in the processing of dairy products.

At pasteurizing doses, most meats, sea foods, certain fruits and vegetables have acceptable flavours. But there may be changes induced that will affect product acceptability. This is especially true in meats where chemical changes lead to appearance degradation in a short time.

In foods containing naturally occurring enzymes, doses several times as severe as those required for sterilization are needed to inactivate such enzymes. And failure to inactivate them leads to flavour and texture changes and, in certain instances, the growth of tyrosine crystals through hydrolysis of protein (*Food Engng.*, October 1959, p. 117).

New tomato grading system: A new inspection procedure that is expected to increase accuracy and efficiency of grading tomatoes for processing has been developed by USDA's Agriculture Marketing Service. It was demonstrated last month at several Eastern plants.

System departs from currently used practices in that colour and condition of tomatoes are determined separately. Colour of raw juice prepared from a representative sample of tomatoes from a growers' load is measured objectively with a newly developed raw juice colorimeter. Condition (or defects) evaluation is still subjective, but not confused with the more difficult one of colour (*Food Engng.*, October 1959, p. 119).

Detection of substitute fats in chocolate products: Adulteration of chocolate products with non-cocoa butter fats can be detected and their quantities estimated by chromatography of fatty acids in the extracted fat. Procedure employs a column of diatomaceous earth prepared with dichloro-dimethyl

silane, liquid paraffin, and acetone-water eluting solutions.

The fatty acids are isolated and placed on the column in a solution of acetone and water. Then they are separated from the calcium by eluting with acetone-water solutions ranging from 20-90 per cent acetone. The eluates are titrated with 0.05 N NaOH to determine amount of fatty acid present. Results can be expressed in a distribution curve with titration values plotted as ordinates and acetone strengths as abscissas (*Food Engng.*, October 1959, p. 119).

Radiation preserving: A French company (Conservatome) has carried out an extensive research programme on the preservation of foodstuffs by means of ionising radiation. It has been found that treatment with gamma or electron rays can, in many cases, provide a satisfactory solution to the problem.

Tests with several varieties of potatoes have shown that budding can be greatly delayed by an irradiation of 5,000 rads and wholly suppressed by one of 7,500 rads. Very strong irradiation, however, has certain detrimental effects. For industrial irradiation methods, a dosage of 10,000 rads appears to be most suitable. Such irradiation does not cause any undesirable changes in the structure of the potatoes treated which retain their freshness for many months. In view of the high waste percentage still encountered in potato storage, the application of such methods can result in very appreciable savings (*Food Manuf.*, October 1959, p. 402).

Fresh-frozen milk: Fresh British dairy milk, treated with sound waves and then frozen solid, may be marketed throughout the world as a result of a project sponsored by the National Research Development Corporation. The project may also enable British farmers to sell any surplus milk at higher prices.

The process will keep milk fresh-frozen for 18 months provided the

temperature of the milk is kept below 8°F; this will enable it to be shipped anywhere, particularly to tropical countries where fresh milk supplies are not normally available.

The new British process is believed the first to achieve complete success for when this milk is thawed out (unlike the currently available frozen homogenised milk) it returns to a completely natural state without any alteration in condition or taste.

The process was evolved by Dr W. G. Wearmouth at the National Institute for Research in Dairying, and the invention is now under the control of the N.R.D.C. which holds patents at home and abroad covering the technique. A major British icecream manufacturing company has been granted a licence to produce the frozen milk which is already being made in small quantities. Full-scale production will start later this year.

The process, after normal pasteurisation, consists of treating the milk with ultrasonic vibrations of about a million cycles per second for five minutes, and pouring it into containers for quick freezing. The process is continuous and there is no delay between the different operations. The milk can be transported in containers of up to 1 gal. capacity in refrigerated ships, trains or lorries, and is also sold in liquid-proof cartons down to $\frac{1}{2}$ pt. size (*Food Manuf.*, October 1959, p. 403).

Cheese production figures: The Soviet Union's production of cheese, although still low per person, has increased by 500 per cent since before the Second World War. In the same period world production has gone up by 70 per cent.

The U.S.S.R. production in 1958 has been estimated at 150,000 metric tons, compared with a pre-war average of 25,000 tons. This figure represents only 5 per cent of the combined output of the 30 countries covered in the review of the Bulletin of Agricultural Economics and Statistics which says although consumption per person has

more than trebled it is still only 0.7 kg. per year.

Other cheese-producers posted large percentage increases in their production. Denmark has more than trebled its output, reaching a 1958 figure of 107,000 metric tons. Production in the U.S.A. has more than doubled, making it the largest cheese producer with 639,000 tons. Seven Latin-American countries have doubled their cheese output since the pre-war period. Among the countries covered in the review, only Canada and Switzerland show little change in production figures (*Food Manuf.*, October 1959, p. 408).

Portable field kit for milk testing: A handy kit for the field testing of milk has been designed by workers of the National Dairy Research Institute, Karnal, and is now in use at Delhi where a scheme to study the bacteriological quality of milk supplies reaching the city is in progress. It is a portable case made of plywood covered with rexine, weighs 5 lb. empty and 15 lb. full, and can accommodate the necessary apparatus for collection and field testing of milk samples. The box is 17 inches long, 8 inches wide and 9 $\frac{1}{2}$ inches high and has an inside length-wise partition which divides it into two compartments, respectively 4 $\frac{1}{2}$ inches and 3 inches wide. The wider of these compartments is meant to contain 28 four-ounce, wide mouth, glass stoppered, empty milk sample bottles in four horizontal stacks. The second compartment has a hinged front which opens outwards and exposes to view space for four 4-ounce reagent bottles, a distilled water bottle, titration flasks and test-tubes. Along the side of the central partition, leather straps can hold in position, a two-piece plunges rod, a thermometer and 10 ml. burette and pipette. The reagent bottles are filled with indicators, standard alkali, phenolphthalein and alcohol which are used in quick tests on milk samples. The plunger discs are hung on the sides of the front compartment.

The kit, auxiliary to an insulated and ice-chilled sample box in which milk samples are carried, has been very useful in field testing work for checking acidity and alcohol reaction. It can be easily fabricated in any locality for as little as Rs 25. The kit may be profitably used by rural milk collection agencies attached to the milk schemes or co-operative organizations.

Further details and drawings of the kit may be had from the Director of Dairy Research, National Dairy Research Institute, Karnal (*Indian Dairyman*, June 1959, p. 127).

NEW INDIAN STANDARDS

Ethylene dibromide and methyl bromide: Both ethylene dibromide and methyl bromide are used as fumigants for control of pests of agricultural and animal husbandry products, such as, fresh fruits, vegetables, foodgrains, stored timber products, hides and skins. They are also used as soil-fumigants. These materials have been covered by the following two Indian Standard Specifications: IS:1311-1958 Ethylene dibromide and IS:1312-1958 Methyl bromide.

These specifications prescribe requirements and methods of test for specific gravity, distillation range, residue on evaporation, free acidity, freezing point, etc. Details of sampling, quality of reagents, packing and marking are also included.

The specification of methyl bromide covers two grades of the material, namely 'without chloropicrin' and 'with chloropicrin'. A small quantity of chloropicrin added to methyl bromide makes it easier to find out whether after the fumigation all its vapours have been exhausted out or not. At the same time, some oleaginous materials can also not be fumigated with such a mixture due to certain chemical changes that are likely to occur in the oleaginous materials themselves. Hence the need for a grade, 'without chloropicrin' (*ISI Bull.*, Sept.-Oct. 1959, p. 228).

Edible tapioca products: Edible tapioca products comprise, among others, tapioca chips and tapioca flour. Tapioca chips are prepared from the fresh tubers of tapioca; and are generally of two types, namely, white and parboiled. Both types are used as food. Tapioca flour, which is prepared by powdering dried tapioca chips either in a disintegrator or in any other grinding mill, is used as an article of food as such or as an ingredient of other processed foods.

These products have been covered by the following two Indian Standard Specifications:

IS:1317-1958 Edible Tapioca Chips, and

IS:1318-1938 Edible Tapioca Flour.

The specification for tapioca deals with both types of chips.

These Indian Standards prescribe requirements and methods of test for moisture, total ash, crude fibre, acid-insoluble ash, etc., and also specify details of sampling, quality of reagents, packing and marking (*ISI Bull.*, Sept.-Oct. 1959, p. 228).

INDIAN PATENTS

(A few of the Patent Applications notified as accepted in Part III, Section 2 of the Gazette of India from 4th to 25th July 1959 are given below):

62,987. *A process for imparting a yellow colour and providing vitamin A fortification to fatty materials:* Incorporating therein vitamin A aldehyde azine.—Patented by Eastman Kodak Company.

62,989: *Stabilized vitamin A composition:* Admixed with 2, 6-ditertiary-butyl-4-methyl phenol, alone or with butylated hydroxy anisole.—Patented by Eastman Kodak Company.

64,836. *Method for preparing pesticidal carrier:* Reacting a diatomaceous calcium silicate with CO₂ at 0-90°C.—Patented by Rohm and Hass Company.

64,422. *Polyethylene structures:* Contacting thin heat-softened poly-

ethylene film with fibrous polyalkalene fabric and pressing these together.—Patented by Union Carbide Corporation.

62,958. *Production of tetracycline:* Aerobically fermenting micro-organisms of genus *Streptomyces* in aqueous medium with a chlorination inhibitor like 3-chloro-6-methylmercapto-pyridazine.—Patented by American Cyanamid Company.

62,752. *Preparation of cobalamins:* Culturing precursor requiring vitamin B₁₂ producing micro-organism in cobalt-containing nutrient medium and treating the separated cell formed with precursor.—Patented by Olin Mathieson Chemical Corporation.

62,029. *Process for the production of an ester having pesticidal activity and pesticidal compositions containing the same:* Reacting pyridine alcohol with dialkyl thiophosphoric acid halide.—Patented by Ruhrchemie Aktiengesellschaft.

FOREIGN PATENTS

815,354. *Dehydrated orange juice:* Dehydrated orange juice, which upon reconstitution has substantially the same flavour as the original juice is prepared by raising the temperature of an orange juice concentrate to 140-155°F. and simultaneously reducing the pressure as rapidly as possible to about 5/16" of mercury maintaining the product under these conditions until it is thoroughly puffed, reducing the temperature of this puffed product to room temperature whilst maintaining the vacuum, and finally grinding the cooled product.

In an example, the concentrate contained 50-60 per cent solids and, after heating to 90°F., it was mixed with corn syrup solids at the rate of 10 parts of concentrate to 4 parts of corn syrup solids; by reducing the pulp content in this manner, the concentrate puffs more readily. Sodium sulphite was then added as a colour preservative. After deaerating at 240°F. under reduced pressure, the temperature was dropped

in two stages to below 155°F. and the product was then puffed. After cooling, the product was crushed to a fineness at which 100 per cent passed through a 10-mesh screen, and then mixed with 1 per cent of a mixture of 5 per cent orange oil and 95 per cent sorbitol. Finally, the product was packed under moisture-proof conditions.—Patented by Vacu-Dry Co. (*Food Manuf.*, October 1959, p. 412).

814,924. Milk concentrate: Claims a powdered fat-containing milk concentrate which readily disperses, even after storage, in water to form a smooth, non-settling and stable dispersion. The concentrates, which comprise 35-88 per cent non-fat milk solids and 12-65 per cent fat, can be prepared by adding a milk-coagulating enzyme, such as rennet or papain, to a fluid fat-containing milk composition having a solids content of 5-70 per cent, preferably 45 per cent, and a fat content of 12-65 per cent (dry basis); the resultant mixture is maintained at the enzyme active temperature and is rapidly heated to inactivate the enzyme after the viscosity, which at first decreases, has increased to at least its initial value.

The fluid fat-containing milk composition may be whole milk, a flavoured milk beverage or dried cream, but, in the last case, the dried material must be dispersed in water prior to the enzyme treatment.—Patented by American Home Products Corporation (*Food Manuf.*, October 1959, p. 412).

815,465. Preserving proteinaceous foodstuffs: In hot, humid, tropical regions, proteinaceous foodstuffs,

such as meat and fish, are generally preserved by rather primitive methods such as drying in the sun, in the case of fish after a preliminary salting. These products usually have a very limited storage life and soon develop unpleasant odours. The efficiency of the preservation appears to depend on the water content of the treated material and, by the known methods it is difficult to obtain a satisfactory and uniform moisture content throughout the product.

It has been found that by mixing the natural undried product in small pieces with 40 per cent to 85 per cent by weight of an amylaceous material, such as a starch-containing flour, for example, manioc flour, the resulting mixture can easily be dried to a moisture content of 10-15 per cent. The final product is perfectly preserved and can be used as a concentrate for tasty soups and other dishes.

In an example, the manioc flour is pre-dried prior to use. With certain fish, such as herring the fish oil may be separated by treating the fish with warm air for several minutes. Finally, a short pre-heating serves to assist the easy recovery of the skin which can be used for glue manufacture.—Patented by F. E. de Vries (*Food Manuf.*, October 1959, p. 412).

816,514. Edible fats: Relates to an improved process for the production of edible fats which may range from products capable of use as substitutes for palm kernel or coconut oil stearines to 'hard' butters capable of use as substitutes for cocoa butter, by any method of molecular rearrangement from essentially a single oil: the product

may be used in the production of biscuit cream fillings, cream filling for chocolate, soft chocolate coatings ice cream chocolate coatings and other applications for which palm kernel or coconut oil stearines have been employed.—Patented by J. Bibby and Sons, Ltd., (*Food Trade Rev.*, October 1959, p. 50).

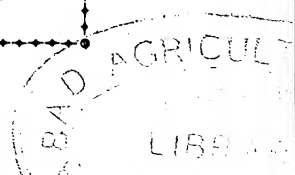
816,343. Oil emulsion: Relates to an oil composition which when incorporated in a mayonnaise imparts to it an improved emulsion stability at low temperatures, and to the provision of an oil suitable for use in salad oil compositions and having improved oxidative stability.—Patented by Thomas Hedley and Co., Ltd. (*Food Trade Rev.*, October 1959, p. 50).

816,202. Treating fruit: A composition for use as a dip for destroying fruit fly larvae and eggs on citrus fruit comprises 20-80 per cent by weight of ethylene dibromide, a petroleum distillate distilling in the range 130-400°C. and having a high degree of freedom from unsaturated and aromatic hydrocarbons and at least one emulsifier capable of producing oil-in-water emulsions.—Patented by N. V. de Bataafsche Petroleum Maatschappij (*Food Trade Rev.*, October 1959, p. 50).

816,313. Preserving: Relates to a method whereby foodstuffs can be preserved in containers made entirely of plastic, e.g., polyvinylchloride: the flat surfaces of the walls of the container, i.e., those which are most liable of deformation, are held fixed between plates—temperatures of 100° C. are permissible.—Patented by K. Van de Kerke (*Food Trade Rev.*, October 1959, p. 53).

RICE CONVENTION

A Rice Convention 1960 of the Association of Cereal Research will take place from May 17-18 at Detmold, Western Germany



Information from Foreign Journals

THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

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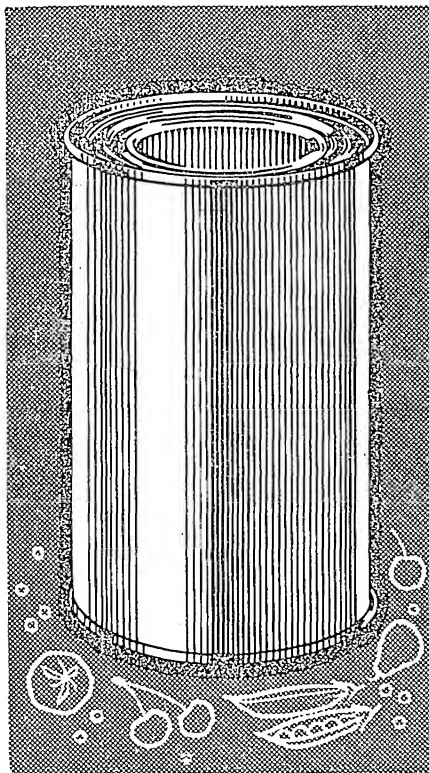
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Aiyars

Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Supplementary value of a protein food based on a blend of cocoanut meal, groundnut flour and bengalgram flour to the diet of children, by Subrahmanyam, V., Doraiswamy, T. R., Bhagavan, R. K., Tasker, P. K., Sankaran, A. N., Rajagopalan, R. and Swaminathan, M., *Ann. Biochem. exptl. Med.*, 1959, 19 (6), 147.—A feeding experiment extending over a period of 8 months was carried out on forty boys aged 7-12 years in a boarding home in Mysore to assess the value of supplementing their diet with 56.8 g. daily of multipurpose food composed of groundnut flour, cocoanut meal and bengalgram flour and fortified with certain vitamins and calcium phosphate.

The children were paired according to initial height and weight and the member of each pair allotted at random to the control and experimental groups. Values for weight, height, nutritional status, haemoglobin level and red-cell count were obtained at the beginning and end of the experiment for the subjects in the two groups.

The increase in height, weight, red-cell count and haemoglobin levels of the subjects in the experimental group receiving the supplement, were significantly higher than those obtained for the control group. Fourteen out of twenty children in the experimental group improved in their nutritional status whereas none in the control group showed any improvement. On the other hand, three children in the control group showed deterioration and the remaining were stationary.

The effect of supplementary protein food containing cocoanut meal, groundnut and Ben-

galgram flours on the metabolism of nitrogen, calcium and phosphorus in children subsisting on a poor rice diet, by Tasker, P. K., Narayana Rao, M., Swaminathan, M. and Subrahmanyam, V., *Ann. Biochem. exptl. Med.*, 1959, 19 (6), 153.—The metabolism of nitrogen, calcium and phosphorus was studied during 5 days in six pairs of boys aged 10-12 years, similar in age, height and weight and fed on a diet based on rice or on the same diet supplemented daily with 56.8 g. of protein food consisting of a blend of low fat cocoanut meal, groundnut flour and Bengal gram flour fortified with calcium phosphate and certain vitamins.

The mean daily nitrogen intakes on the rice diet and rice-protein food diet were 6.73 g. and 9.94 g. respectively. All the children in the two groups maintained positive nitrogen balance. The daily nitrogen retention on the rice-protein food diet (2.12 g.) was significantly higher ($P < 0.05$) than that on the rice diet (1.37 g.)

The mean daily intakes of calcium on the rice diet and rice-protein food diet were 631 mg. and 853 mg. respectively. All the subjects in the two groups were in positive calcium balance. The daily retention of calcium in the subjects on the rice-protein food diet (355 mg.) was significantly higher ($P < 0.05$) than that observed on the rice diet (255 mg.).

The mean daily intakes of phosphorus on the rice diet and rice-protein food diet were 1144 mg. and 1483 mg. respectively. All the subjects in the two groups were in positive phosphorus balance. The daily retention of phosphorus

on the rice-protein food diet (538 mg.) was significantly higher than that observed on the rice diet (434 mg.).

Processing of turmeric, by Desikachar, H. S. R., Srinivasan, M. and Subrahmanyam V., *Res. & Ind.*, 1959, 4 (7), 172.—In the conventional method of processing raw turmeric tubers for improving their appearance and colour, they are first boiled in cowdung extract and subsequently treated with an emulsion made of castor seed paste, alum and Chemichrome (a brand of lead chromate). The first treatment is neither hygienic nor aesthetic, and the latter treatment contaminates the tubers with lead which is a cumulative poison.

As a result of studies conducted at the Central Food Technological Research Institute, Mysore, a method has been worked out in which neither cowdung nor lead chromate is used. The tubers are boiled in lime water, sodium carbonate or sodium bicarbonate solution instead of cowdung extract. A solution containing 20 g. sodium bisulphite and 20 g. concentrated hydrochloric acid per 150 lb. of tubers is recommended in place of Chemichrome to give them the desired yellow tint.

Production of malt extract—Project costs, by Chandrasekhara, M. R., Narayana Rao, M., Swaminathan, M., Lahiry, N. L., Bhatia, D. S., Parpia, H. A. B. and Subrahmanyam, V., *Res. & Ind.*, 1959, 4 (8), 189.—The present production of malt extract in India is insufficient to meet the requirements and considerable amounts of it are imported. This is despite the fact that cereals like *ragi* (*Eleusine coracana*), *jowar* (*Sorghum vulgare*) and barley, suitable for the prepa-

ration of malt and malt extract are available in the country. The development of indigenous malt extract industry has been hampered

primarily due to the non-availability of know-how. The details of a process worked out at the Central Food Technological Research Ins-

titute, Mysore, for the preparation of malt extract from *ragi* and the project cost data for the same are presented in this paper.

PART II (Indian)

ADULTERATION

Detection of traces of argemone oil in mustard oil—a micro test, by Chakravarti, R. N., *et al.*, *J. & Proc. Inst. Chem.*, 1959, 31 (3), 118.—Argemone oil is commonly admixed with mustard oil and several tests are adopted to detect the presence of the same. Of the seven tests mentioned, the hydrochloric acid test appears to be quite simple and sensitive. It consists in treating the ethereal solution of the sample of oil with a few drops of a 20 per cent aqueous solution of hydrochloric acid and keeping for sufficient time. An orange to yellow colour appears in the aqueous layer indicating the presence of argemone oil. All the tests are, however, micro-tests and are not useful in detecting the argemone oil, if present in minute traces. The AA. have reported in this paper a micro-test which can detect the presence of as low as 0.005 per cent of argemone oil in mustard oil. For carrying out this spot test, 1 ml. of the adulterated oil is diluted with 1 ml. of ether in a small test tube and then six drops of 20 per cent HCl are added. The test tube is tightly plugged with cotton wool and kept for two days after which the lower aqueous layer is transferred to a 1 ml. tube and washed twice by decantation with ether. After removing all the ether, the aqueous solution was put on a filter paper in the form of a spot which is then dried. When the spot is observed in presence of ultra-violet light using Wood's filter, a yellow fluorescence is seen. This fluorescence test is positive only when mustard oil is adulterated with argemone oil. Pure mustard oil under identical conditions fails to give any fluorescence. This can be further confirmed by paper partition chromatographic procedure, the details of which are given. K.L.R.

Chromatographic detection of opium in tea and other foods, by Sengupta, P. V., Mitra, S. N. and Roy, B. R., *J. & Proc. Inst. Chem.*, 1959, 31 (3), 124.—It is likely that prepared tea and milk preparations may be adulterated with opium and a chromatographic method has been reported in this paper for detecting the same. The method depends on the identification and isolation of the opium alkaloids particularly morphine which is present in maximum amount in opium. The procedure consists in placing a drop or two of the test solution (liquid tea or any other beverage) on Whatman No. 1 filter paper, keeping the paper horizontally over a petridish containing the solvent and covering the whole thing with a glass cover or bell jar to make it air-tight. The chromatogram is run for 2-3 hr., after which the paper is taken out, dried under fan for about 1/2 hour and then sprayed lightly with the iodo-platinic chloride developer. The immediate appearance of bluish green streaks or scars indicates the presence of opium. No such colour appears with pure tea and milk preparations. Prepared tea as well as milk preparations containing various proportions of opium, *viz.*, 1, 2, 5 and 10 per cent were subjected to the chromatographic test. It was found that the test could easily detect up to 2 per cent of opium in the foodstuff. With 1 per cent opium, faint bluish green streaks appear. Presence of opium can also be confirmed by isolating the alkaloid, morphine, from the foodstuff. The details of the procedure for isolation are also given. K.L.R.

ANALYTICAL

Sodium and potassium contents of some food materials, by Roychowdhury, S. P. and Gyani, B. P., *Indian J. appl. Chem.*, 1958, 2 (3), 113.—It is necessary to know

the sodium content of foodstuffs commonly consumed particularly when a low sodium diet has to be evolved. The total sodium content in such diets must be as low as 500 mg. per day. This has to be attained without affecting the nutritive value of the diet with respect to other factors. The AA. have determined the sodium and potassium contents of several food materials by ashing the material (1-2g.) in a muffle furnace at $573 \pm 20^\circ\text{C}$ for 4. hours after which the ash is taken up in a small quantity (0.5 c.c.) of concentrated HCl and then making up to a known volume by adding distilled water. Solutions thus prepared were used for measurements in a flame photometer. The values for sodium and potassium were read out from standard curves. The sodium and potassium contents of several cereals, pulses, leafy and other vegetables, condiments and miscellaneous foodstuffs are reported in the paper. The sodium content of a balanced diet has been calculated and given. Based on this figure, it is found that a restricted sodium diet could be easily obtained if use of table salt is omitted. The chief sources of sodium in the above diet are drinking water and milk. If, however, a very low sodium diet is required, it is advisable to use milk and milk products sparingly and drink rain water wherever available as additional checks on sodium intake. K.L.R.

BIOCHEMISTRY AND NUTRITION

Distribution of phospholipids and cholesterol in normal human beings, by Patil, V.S., Tattani M. H. and Magar, N. G., *Ann. Biochem. exptl. Med.*, 1959, 19 (8), 183.—The study of serum phospholipids is gaining impetus now because of its possible relation to atherosclerosis. In this paper, the

AA. have studied the distribution of serum phospholipids of Indians of different age groups. Blood serum of 52 normal male subjects of different age groups varying from 30 to 60 years have been analysed for total, free and ester cholesterol, total phospholipids, lecithin, sphingomyelin and cephalin. The values for all the factors except cephalin significantly increased in the age-group 50-60 as compared to those of the age-group 30-40. Higher cholesterol value with rising age was manifested by the ester fraction of the cholesterol. The phospholipids of the sera were largely made up of lecithin and sphingomyelin. Cephalin was also found to be present in subjects of all the age-groups but there was pronounced effect of increasing age on this component.

K.L.R.

Urease in wheat leaves, by Gupta, Y. P. and Das, N. B., *Ann. Biochem. exptl. Med.*, 1959, 19 (8), 199.—Studies on the urease activity in wheat leaves have been presented here. It was found that urease, which hydrolyses urea into ammonia and carbon dioxide, is present in wheat leaves in low concentrations. This enzyme was found to be mainly in the soluble portion and was present at different stages of growth (pre-flowering and post-flowering). Partial purification of this enzyme was done with alcohol or acetone. Acetone proved to be better than alcohol for this purpose. Some properties of this enzyme preparation were studied. In a manometric experiment, theoretical amounts of carbon dioxide and ammonia were released. The enzyme was found to lose its activity on heating for 15 minutes and was not affected by prolonged dialysis in the cold. The optimum pH value for its activity was found to be between 7.0 and 7.5. The activity increased with the increase in the concentration of the enzyme as well as with the period of the reaction. Sodium fluoride showed strong inhibition of the enzymic activity.

The oxidation of amino-acids by plant mitochondria, by Das, H. K. and Roy, S. C., *Ann. Biochem. exptl. Med.*, 1959, 19 (9), 225.—Mitochondria have been isolated from etiolated germinating seeds of *P. aureus*, *V. sinensis* and *V. catieng*. Their ability for the oxidation of amino-acids has been studied with the help of 2:3:5-triphenyltetrazolium chloride.

Of the twenty-two amino-acids studied, only *L*-glutamic acid, *L*-cysteine, glycine and *DL*-alanine were found to be oxidized relatively at a higher rate. Preparations from 48-hr. old seedlings were found to be most active. Incorporation of phosphate in the homogenization medium increased the ability of mitochondria to oxidize amino-acids, while washing decreased it. Prolonged contact with phosphate is injurious to mitochondria obtained from the seedlings of *P. aureus* but it has no effect on those from *V. sinensis*. The pH of the homogenization medium should be kept at 7.0-7.2 in case of *P. aureus* and at 6.6 in case of *V. sinensis*.

Studies on pyridine nucleotide metabolism. Part III. Effect of protein deficiency on the synthesis of ribose phosphate from glucose-6-phosphate in rat liver and blood, by Tulpule, P. G., *Indian J. med. Res.*, 1959, 47 (3), 240.—The investigations on the biosynthesis of ribose phosphate by oxidative decarboxylation of glucose-6-phosphate with the partially purified enzyme preparations of liver and red blood cells of albino rats were undertaken in an effort to approach the problem of pentose synthesis in nucleotides. The results of these studies indicated that in acute protein deficiency the enzymes concerned with the synthesis of ribose via the oxidative pathway of hexose monophosphate shunt by the tissues concerned remained unaffected even when the DPN synthesizing capacity of liver had markedly deteriorated.

Studies on human lactation. Part I. Diet survey of lactating women in different socio-economic

groups and the effects of socio-economic status and stage of lactation on the proximate principles and essential amino acids of human milk, by Karmarkar, M. G., *et al.*, *Indian J. med. Res.*, 1959, 47 (3), 344.—A survey of the dietary intake of lactating women belonging to various socio-economic groups shows that the diet of lactating women, particularly of the very poor and poor classes, is far inadequate with regard to calories, protein and calcium. The fat content of milk is found to be less in the very poor class than in the other groups studied. The middle class shows a superiority with regard to some of the amino acids in milk, *viz.*, histidine, arginine and threonine. A decrease in fat, protein and amino-acid contents of milk is observed after the first month of lactation after which values remain more or less steady. The values for protein were found to compare well with those reported for subjects and to be considerably higher than those reported for British, American and other subjects. The values for fat were found to compare well with British, American and Australian subjects and to be generally higher than those reported for other groups. The amino-acid content of milk in the subjects studied appears, as compared with other groups, to be low, with regard to, leucine and valine and favourable with regard to histidine, isoleucine, lysine, arginine and threonine.

Studies on human lactation. Part II. Effect of socio-economic status on the vitamin content of human milk, by Deodhar, A. D. and Ramakrishnan, C. V., *Indian J. med. Res.*, 1959, 47 (3), 352.—Studies carried out on the effects of socio-economic status and stage of lactation on the vitamin content of human milk show that the contents of pantothenic acid and vitamin B₁₂ progressively increase with socio-economic status. With regard to vitamin B₁ content of milk, the very poor group shows a significant superiority over other groups. The

state of lactation seems to have no effect on vitamin B₁ and vitamin B₁₂ contents of milk. In the case of pantothenic acid and vitamin B₂, the value remains more or less steady after the first month of lactation.

Dietetic hepatic lesions. Influence of protein level and vitamin B₂ complex deficiency on the liver of rats, by Datta, N. C., Krishnan, L. S. and Radhakrishna Rao, M. V., *Proc. Indian Aca. Sci.*, 1959, 50 (6), 340.—Attempts have been made to induce hepatic lesions in albino rats by varying the quantity of the protein (casein) and by withholding the supply of the vitamins of the B₂ complex. On the vitamin B₂ complex deficient diets, the average life-span of the rats was largely influenced by the casein content of the diet, while those which received similar casein diets with yeast as supplement lived longer. Fatty infiltration of the liver with progressive fibrosis (akin to human portal cirrhosis) can be more easily produced in rats by prolonged feeding of diets low in protein (casein) content and deficient in the vitamins of the B₂ complex. Increasing the level of protein (casein) in the diet or supplementing low protein diets with yeast has a marked corrective effect on fatty infiltration of the liver and this is attributed to their respective methionine and choline contents. In general, the vitamins of the B₂ complex have a marked beneficial effect on the fatty livers when given early enough as a supplement.

FRUIT AND VEGETABLE PRODUCTS

Studies on ascorbic acid in bitter gourd and cauliflower, by Tewari, C. P., *Ann. Biochem. exptl. Med.*, 1959, 19 (8), 191.—On cooking, bitter gourd and *Tricosanthes dioica* suffered loss of ascorbic acid, but the loss undergone by the former was generally less. The practice of debittering of bitter gourd by salting and drainage of fluid is not desirable as it leads to loss of

ascorbic acid. On the basis of retention of ascorbic acid during boiling with distilled water, vegetables could be divided roughly into two groups; the first group, represented by bitter gourd and cauliflower, retained more of ascorbic acid than the second group. Cauliflower and the leaves of knolkhol undergo the same degree of loss of ascorbic acid whether cooked or merely boiled with tap water. Stored bitter gourd and cauliflower suffered a greater loss of ascorbic acid than the fresh vegetables on boiling. Storage of bitter gourd leads to the gradual transformation of ascorbic acid to dehydroascorbic acid and diketogulonic acid. These transformations are more rapid at 37°C than at 3°-4°C and are most marked when the frozen material is allowed to thaw. Dehydroascorbic acid and diketogulonic acid could not be detected in significant quantities when cauliflower was stored at 3°-4°C and at 28°-31°C. However, thawing of frozen cauliflower results in complete transformation of ascorbic acid into dehydroascorbic acid and diketogulonic acid. The loss undergone by dehydroascorbic acid and diketogulonic acid on boiling of vegetables was usually greater than that of ascorbic acid.

Studies in the nutritional values of Indian vegetables. Part I—(N.O. Cucurbitaceae), by Dhargalkar, M. D. and Guha, S. K., *J. & Proc. Inst. Chem.*, 1959, 31 (3), 109.—In this study, analysis of vegetables of the cucurbitaceae family which are widely grown and are cheap, has been undertaken with a view to assessing their nutritive value and find out in particular as to how far they can meet the protein requirements of poor people. The fresh fruits of *Coccinia indica* W. and A., *Cucurbita maxima* Duchesne, *Luffa achantangula* Roxb., *Momordica charantia* Linn. and *Trichosanthes anguina* Linn. have been used for the analysis after drying. Values for ash, moisture, soluble extractives in ether, alcohol, chloroform and water, protein and

fixed oil are given. The protein content of the dry fruits varies from 13.23 to 23.62 per cent, thus indicating that the vegetables are fairly a good source of protein. The amino acids present in the fruits have been identified by paper chromatographic technique and the following are found to be present in the hydrolysates of the fruits, alanine, arginine, aspartic acid, cysteine, glutamic acid, histidine: leucines, methionine, phenylalanine, serine, threonine and valine.

K.L.R.

Studies on the microbial spoilage of canned food. I. Isolation and identification of some spoilage bacteria, by Rangaswami, G. and Venkatesan, R., *Proc. Indian Aca. Sci.*, 50 (6), 349.—In an attempt to study the microbial spoilage of canned food seven bacteria were isolated from seven different spoiled canned foods collected from various sources. When the pure cultures of the bacterial isolates were inoculated into freshly prepared and sterilized cans of curried vegetable, sliced potato and mixed fruit, all of them proved to cause harmful effects to a lesser or greater extent.

The bacteria were studied in detail for their morphological, cultural and physiological properties including their capacity to utilize certain carbon and nitrogen sources and on the basis of the results obtained they are identified as *Bacillus circulans* Jordan, *B. brevis* Migula, *B. subtilis* Cohn, *B. coagulans* Hammer, *B. licheniformis* (Weighmann) Chester, *Lactobacillus fermenti* Beijerinck and *Clostridium histolyticum* (Weinberg and Seguin) Bergey *et al.*

Ascorbigen in plant materials, by Bose, S. and Guha, B. C., *Sci. & Cult.*, 1959, 25 (6), 387.—Ascorbigen, a bound form of ascorbic acid, has been reported to be present in cabbage and a method of isolating it has been developed. In this note, a chromatographic procedure is described for identifying ascorbigen and distinguish it from ascorbic acid and indole-3-acetic

acid (IAA) which are believed to be the products of acid hydrolysis of ascorbigen. Ascorbigen has been subjected to ascending paper chromatography using various solvents of which ethyl acetate-chloroform (4:2) and methanol-*n*-butanol (4:2) gave good results. Among the detecting reagents tried, Ehrlich's reagent, formalin-HCl and 2, 4-dichlorophenol-indophenol were found most suitable in distinguishing ascorbigen from ascorbic acid and IAA. Contrary to earlier report that the occurrence of ascorbigen is restricted to the family *Cruciferae*, the AA. have found ascorbigen in certain non-cruciferous plant materials. The range of values for the ascorbigen content of two varieties of chillies, 3 varieties of bitter-gourd and of guava are given.

K.L.R.

OILS AND FATS

Toxicity limit of argemone oil, by Mullick, D. N., *Indian J. med. Res.*, 1959, 47 (3), 311.—Argemone oil, which is commonly used for adulterating mustard oil, is known to produce toxic effects like epidemic dropsy-like condition. No data is, however, available on the lower limit of argemone oil in mustard oil that can produce the toxic symptoms. In this study, the author has attempted to find out the tolerance limit of argemone oil in mustard oil by rat feeding experiments. Six groups of rats were fed with the usual synthetic diet containing mustard oil and supplemented with different quantities, *viz.*, 0, 0.5, 1.0, 2.0, 4.0 and 8.0 ml. of argemone oil. Records of weekly body-weight, clinical condition, mortality, reproductive performance, haemoglobin concentration of the blood and feed consumption were maintained over a period of 40 weeks. The results obtained have been presented and discussed. It was found that rats fed higher amounts of argemone oil (2-8 ml.) showed retarded growth from as early as fourth to fifth week after the feeding started. The clinical conditions were not conspicuous and mortality

was not recorded till 24 weeks after which period the animals showed abnormal conditions of illness. The reproductive capacity of the rats fed diet supplemented with 2.0, 4.0, and 8.0 ml. of argemone oil was completely affected and there was no sign of pregnancy. Higher amounts of argemone oil leads to lower haemoglobin concentration and lesser ingestion of feed. The results indicate that the presence of argemone oil at a level of 1 ml. or more in the diet limits the intake of nutrients resulting in malnutrition and leading to the disease symptoms observed.

TEA

Caffeine and tannin contents of stalky tea, by Sarkar, S. R., *Curr. Sci.*, 1959, 28, (9), 366.—The Food Adulteration Rules have laid down that the crude fibre content of tea should not be more than 15 per cent. No distinction is made between dust, leafy and stalky tea in the standard and as such even stalky tea having high fibre is found to pass the prescribed standard of crude fibre. As the flavour of tea beverage depends mainly on the caffeine and tannin contents, the author has analysed 50 samples of tea to find out whether any correlation exists between the crude fibre content and the caffeine and tannin contents of stalky tea. The range of values for crude fibre, caffeine and tannin obtained are given. The results show that there is no correlation between crude fibre value and caffeine and tannin contents of stalky tea. The caffeine and tannin values are low ranging between 2.0-3.0 and 5.2-9.6 respectively.

K.L.R.

K.L.R.

GENERAL

Jujubes from tamarind seed jellose, by Rao, P.S., *Res & Ind.*, 1959, 4 (7), 173.—Jujubes available in the market are mostly gelatine-based and are, therefore, unacceptable to the vegetarian section of the people. A method is reported in this paper for the preparation of

jujubes in which jellose, a constituents of tamarind seeds, is used in place of gelatine. Tamarind seed being an inexpensive commodity the cost of production is mainly contributed by sugar, and at the existing price level of sugar (Rs. 1.1/kg.) it works out to Rs. 1.92/kg. Compared to this, the current price of gelatine-based jujubes is Rs 3.06/kg.

The method of preparation involves the following steps: (i) extracting jellose by boiling crushed tamarind kernel with water; (ii) adding sugar and a suitable dye; (iii) concentrating the extract to to 65°-70° brix; (iv) allowing the concentrate to set in a cool place; (v) cutting the jelly into pieces of the desired shape and size; (vi) drying them in the sun or in an air-oven at 40°-45°C; and (vii) coating the pieces with sugar and cornflour.

Resilient pads from bamboo waste, by Jain, N. C., *Res. & Ind.*, 1959, 4 (8), 192.—A method is reported for the preparation of resilient pads, used for packing motor transport batteries, from shavings, a waste material obtained during the manufacture of bamboo boards. Till now, the entire demand for these pads (c. 108,000 per year) has been met through imports.

The process consists in mixing bamboo shavings, cut to a uniform size (2-3 in. long), with cold setting cashewnut shell liquid adhesive, pressing them under moderate pressure for 24 hr. and allowing the pads formed to condition for one week. The pads obtained are comparable both in cost and performance to imported ones.

Wax from sisal waste, by Mhaskar, V. V., Hinge, V. K. and Shah, S. M., *Res. & Ind.*, 1959, 4 (9), 219.—In the absence of indigenous sources of carnauba and other similar hard waxes required in the preparation of polishing compositions and in the manufacture of carbon papers, India has to spend Rs 16-20 lakhs annually in importing carnauba wax and polishing compositions. Investigations in progress at the National Chemical Labo-

ratory, Poona, with the object of finding substitutes for carnauba wax from indigenous sources have shown that the wax recovered from the waste material left over after separa-

ting the fibre from the leaves of plants of the Agave family, commonly known as sisal, can replace carnauba wax in many of its uses. Sisal wax resembles carnauba wax

in solvent takeup and heat resistance—properties that determine the suitability of a wax for use in the preparation of polishing compositions.

PART III (Foreign)

ANALYTICAL

Determination of aluminium and iron in plant tissue, by Rubins, E. J. and Hagstrom, G. R., *J. agric. Fd. Chem.*, 1959, 7 (10), 722.—A procedure has been developed for the fluorometric determination of small quantities of aluminium in perchloric acid digests of plant tissue using 8-quinolinol. Iron is first removed and determined by formation of the ferrous complex of 4, 7-diphenyl-1, 10-phenanthroline (bathophenanthroline) at pH 3-4, followed by extraction with chloroform containing a little iso-amyl alcohol. The fluorescent complex of aluminium with 8-quinolinol is extracted with chloroform at pH 4.7-5.1. Quantities of iron up to 20 γ and of aluminium up to 10 γ are determined. Manganese, copper, and zinc in amounts usually encountered in plant tissue do not interfere.

Micro method for the determination of calcium and magnesium in general biological material, by Hunter, G., *Analyst*, 1960, 85, 12.—A micro method for the determination of calcium and magnesium in general biological material is described and critically examined. A simple quantitative device for the comminution of tissues is described, with a method of treating the ground material with trichloroacetic acid. An alternative ashing procedure is also described.

The calcium and magnesium are precipitated together as phosphates from the trichloroacetic acid filtrate or from the solution of the ash. Calcium and magnesium are shown to be thus quantitatively recoverable at or above concentrations of 7×10^{-6} and 2.4×10^{-6} mole per litre, respectively. The metals are thus separated from excess of phos-

phate and iron and from copper and zinc. The solution of the precipitate is often directly titratable for calcium and calcium plus magnesium by the method already described by Hunter.

Interfering metals, which may under certain conditions accompany the phosphate precipitate, are removed from its solution by treatment with diethyldithiocarbamic acid and extraction with carbon tetrachloride. Diethyldithiocarbamate does not compete with the metal indicators for calcium and magnesium, and, as the solubility of carbon tetrachloride in water is negligible, there is no volume change in the aqueous phase.

In order to test the method, analyses by different procedures of biological materials with widely varying chemical compositions are given. The particular procedure chosen depends on the nature of the material to be analysed and for most materials may be made a simple routine operation.

A paper chromatographic method for lactase and maltose activity determination, by Philippu, A. J., *Enzymologia*, 1960, 21 (4), 216.—The determination of lactase or maltose activity of different tissues is based on the difference of the reductive power of a tissue substrate mixture before and after incubation for a constant time at a constant temperature. It is expressed in percentage of lactose or maltose hydrolysis. The present paper deals with a method by which the unhydrolysed lactose or maltose after incubation is determined by using a paper chromatographic technique for the separation of these sugars from their derivatives of hydrolysis. The tissue having the enzyme activity is homogenised with water, the homogenate mixed

with 4 per cent solution of lactose in a buffer of pH 5.6 and a few drops of toluene are added. The mixture is incubated at 38°C for periods ranging from 30 minutes to four hours. After incubation, 10 per cent solution of trichloroacetic acid is added to the homogenate mixture, the tube shaken vigorously and after 5 minutes the contents are filtered. A control batch is maintained in a similar way but with the addition of TCA before incubation so that the enzyme activity is completely inhibited. The filtrate is used for spotting on Whatman No. 1 circular paper. The chromatogram is developed using the solvent, n-propanol: ethyl acetate: water: *a*-picoline (14:2:4:9 v/v). After standing for 8 hr., the chromatogram is dried and cut. One half is sprayed with a dye solution suitable for detecting reducing sugars. The lactose area from the non-sprayed half of the chromatogram is cut and used for quantitative determination of unhydrolysed lactose by the colorimetric method using a spectrophotometer. The results are expressed in μ g. of hydrolysed lactose by determining the difference of lactose concentration between the inhibited and the active homogenate-lactose solution. Same procedure is followed for maltose determination by using 4 per cent maltose at pH 6.2 in place of lactose, the incubation temperature being 35°C.

K.L.R.

BIOCHEMISTRY AND NUTRITION

Dietary protein requirements and problems of supplementation, by Allison, J. B., *et al.*, *Food Technol.*, 1959, 13 (11), 597.—Protein requirements and problems involving supplementation are dis-

cussed. The need to supply to the body adequate nitrogen for growth and maintenance, with sufficient of the indispensable amino acids in proper proportion for cellular protein synthesis, is emphasized. The average American diet meets this need. A good argument, however, can be made for the improvement of single items in the American diet which may be major constituents or may become major constituents periodically in the diet of individuals. Such an improvement should take into consideration the need for an over-all balanced diet. Data are presented to show that simply improving the amino acid pattern without adjusting the protein intake to meet requirements would not be nutritionally adequate. Furthermore, the protein requirement should be related to the caloric intake and balance between carbohydrate and fat calories. Energy needs of the body receive first consideration in metabolism. Any deficiency in calories results in the oxidation of amino acids to supply energy. The body is thus deprived of these building blocks for cellular protein synthesis. Food technologists and nutritionists should give consideration to the establishment of proper balance between calories and proteins in certain basic food-stuffs. Balanced foods should be provided for all ages. A good working rule might be that dietary constituents should be developed that will make it difficult to provide an *unbalanced* diet to the family. A balanced diet is one that has an efficient protein in proper amounts, carbohydrate and fat calories, minerals, essential fatty acids, the vitamins—all in optimum proportions.

A study of the decomposition of urea by the aqueous extract of *Glycine sojabean*, by Bahadur, K. and Chandra, V., *Enzymologia*, 1960, 21 (4), 209.—Although the presence of urease in soyabean (*Glycine soja*) is long known, the nature of its action in natural environment has not been fully studied. The role of urease in plants is still obscure and as such a thorough

investigation of the proteins with urease activity in their natural environment and a study of the possible role they play in plant and animal tissues is very essential. The A.A. have studied the decomposition of a 1 per cent solution of urea by varying volumes (10-80 ml.) of a 10.0 per cent soyabean powder extract at pH 9.6 and at different intervals of time. Maximum decomposition is observed with 20 ml. of soyabean powder extract and the decomposition of urea is maximum in the first 24 hr. in all cases as measured from the alkalinity of the reaction mixture. After this period, the alkalinity goes on decreasing even when increasing volumes of soyabean powder extract are used. Maximum decrease results with 80 ml. of the extract. The decrease in alkalinity cannot be possibly due to the escaping of ammonia formed by decomposition of urea but may be explained to be due to the probability of part of the ammonia being used up in the formation of amides and amino acids from the α -keto and α -hydroxy acids formed in the soyabean extract. This view is supported by the increasing concentration of amino acids actually found in mixtures containing 60, 70 and 80 ml. of soyabean extract at higher intervals of time. The fact that the decomposition of urea is not proportionate to the increase in volume of the extract probably indicates the presence of some urease inhibitor.

COCOA

Processing of raw cocoa. III. Enzymic aspects of cocoa fermentation, by Holden, M., *J. Sci. Fd. Agric.*, 1959, 10 (12), 691.—The changes in the levels of a number of oxidising and carbohydrate-splitting enzymes of Amelonado cocoa bean cotyledons during both large- and small-scale fermentations were determined, on samples of beans taken after various periods of fermentation from the top and centre of heaps of different sizes. Inactivation of enzymes took

place sooner in the top layer, where the temperature rise was more rapid than at the centre. Enzyme levels started to diminish during the period when the beans were drying and continued until, after 3 days' fermentation, little or no activity was detectable. The results suggest that prolonging fermentation for several days after the beans are dead is neither necessary nor desirable.

A germination inhibitor which was found in the pulp and testa of beans decreased in amount during ripening and disappeared during fermentation. Preliminary attempts were made to separate the inhibitor.

DAIRY

Effects of feeding low levels of insecticide residues on hay to dairy cattle on flavour and residues in milk, by Gyrisco, G. G. *et al.*, *J. agric. Fd. Chem.*, 1959, 7 (10), 707.—Low levels of aldrin, lindane, DDT, parathion, and methoxychlor residues on hay up to 10 p.p.m., were fed to dairy cows for periods up to 3 months. No parathion or methoxychlor were found in any of the milk samples. No lindane was found in the milk in the 1950-51 experiment, but in 1951-52 the mean lindane residue content for all sampling dates was significantly greater than that of the check. However, the lindane present at any single sample date not significantly different from the was check. Small but significant amounts of DDT and aldrin were present in the milk when cows were fed 10 p.p.m., of each for 1 month. At 2 to 4 p.p.m., no aldrin was detected and no effect was noted on the cows' well-being or vital organs of the slaughtered cows. There were no off-flavours or odours attributable to the feeding of any of the insecticides.

DEHYDRATION

Interactions between copper ions and sweet potato polyphenolase oxidized substrates, by Arthur, J. C. and McLemore, T. A. *J. agric. Fd. Chem.*, 1959, 7 (10),

714.—The formation of copper complexes with sweet potato polyphenolase and oxidized catechol was determined, using copper-64 and an ion exchange method. An increase in enzyme or cupric ion concentration increased the apparent amount of cupric ion complexed and/or exchanged. An increase in oxidation time—oxidized substrate concentration—also increased the apparent amount of cupric ion interacting with the components of the solution. A change in experimental conditions—the pH of the solution at the time of addition of cation exchanger—affected the results quantitatively; however, the same qualitative result were obtained. These data may indicate a possible way of decreasing the effective enzyme concentration during the polyphenolase catalyzed oxidations.

DESIGNING

Designing of freeze-drying equipment for the dehydration of foodstuffs, by Smithies, W. R. and Blakley, T. S., *Food Technol.*, 1959, 13 (11), 610.—There is no equipment designed specifically for freeze-drying food on a large scale. For such equipment the following characteristics are of importance: simplicity of construction; quick loading; prevention of thawing during loading and pump down; ability to run without supervision and adjustments; ability to dry a variety of products of various shapes and textures; reasonably rapid drying; uniformly heavy loading of the vacuum chambers to make maximum use of pumping capacity. A method of achieving these is by the use of chambers fitted with blackened shelves, electrically heated and movable so that the number of shelves and the space between them may be varied as desired. The material to be dried is laid on trays or between aluminium plates or, for layers thicker than 1/2 inch, between plates fitted with aluminium spikes, and then frozen. For drying, the trays or plates are loaded between the heating shelves leaving

a small gap of 1/4 to 1/2 inch at the top and bottom. Thermostatically controlled radiant heat from the shelves provides efficient heat transfer for drying cycles of from four to seven hours. Evacuation of the system may be by steam ejector or by mechanical pump plus ice condenser, depending on the facilities available.

FISH

Kinetics of phosphate-buffered, ribose-amino reactions at 40 and 70 per cent relative humidity: Systems related to the 'browning' of dehydrated and salt cod, by Jones, N. R., *J. Sci. Fd. Agric.*, 1959, 10 (11), 615.—The development of brown pigmentation, the disappearance of reactants and changes in the fluorescence of reaction mixtures of ribose with individual compounds present in cod muscle extractives have been measured. These data are discussed, together with chromatographic evidence, in relation to general 'browning' theory. By reference to the known composition of the extractives of fresh and of chill-stored muscle, the relative importance of the different nitrogenous compounds in the early stages of the 'browning' of dehydrated and of salt cod is postulated.

The effect of sodium chloride on proteolysis and on the fate of amino acids present in the muscle of codfish (*Gadus callarias*), by Bilinski, E. and Fougere, H., *J. Fish. Res. Bd. Canada*, 1959, 16 (5), 747.—The rate of proteolysis and the deamination of free amino acids in cod muscle treated with 4, 8, 12 and 16 per cent sodium chloride varies with the sodium chloride content and temperature. Proteolysis of the fish muscle protein is completely inhibited at concentrations of 16 and 12 per cent sodium chloride. Trimethylamine formation is inhibited by 16 and 12 per cent sodium chloride. Trimethylamine formation is inhibited by 16 per cent sodium chloride for at least 15 days. Both inhibitions take place at either 15 or 25°C. In

salted muscle deamination can occur in the absence of trimethylamine formation. The reaction appears to be hardly influenced by salt. Indole formation is completely inhibited by 8 per cent salt at either 15 or 25°C.

FRUIT AND VEGETABLE PRODUCTS

Formation of pyrrolidonecarboxylic acid in processed fruit and vegetable products, by Mahdi A. A., Rice, A. C. and Weckel, K. G., *J. agric. Fd. Chem.*, 1959, 7 (10), 712.—Pyrrolidonecarboxylic acid is produced in processed fruit and vegetable products during heating both in the blanch and sterilization processes. Pyrrolidonecarboxylic acid and its two possible precursors, glutamine and glutamic acid, were measured by partition chromatography in cherries, peas, snap beans, Lima beans, beets, sweet corn, and tomato juice, before and after heat processing and during a 2-year storage period. Although both possible precursors were present in most products examined, only glutamine contributed to the pyrrolidonecarboxylic acid present after processing.

Concentrated apple juice and esters—versatile products, by Butland, P., *Canad. Food Ind.*, 1960, 31 (1), 26.—The process of manufacturing concentrated apple juice and esters is given. The method consists in pressing selected and washed apples in three stages where up to 85 per cent juice is extracted, centrifuging and filtering the extracted juice. An enzyme, pectinase, is added to the juice in order to break down the pectin into simple monosaccharide sugars such as glucose, fructose, levulose, etc., as otherwise a thick solid mass would result after concentrating the juice containing pectin. After the enzyme action is complete, the juice is pumped into continuous flash film evaporators, where it is concentrated to one sixth its original volume in 15 seconds at 115°F. The resulting concentrate is standardised to 38° Baume and stored in drums. The

distillate obtained during evaporation is sent through a stripping column where at 205°F the esters are separated. The esters of apple juice contain alcohol (ethanol), various esters of monocarboxylic acid, and aldehydes. No preservative of any type is used to preserve the concentrate or esters. The concentrate reconstitutes into a delightful drink with water. Use of apple concentrate and esters in the preparation of a few new products is mentioned. Methods of making apple drink, apple wine, apple pop, mincemeat, apple jelly, vinegar and frozen pies are briefly given.

K.L.R.

MICROBIOLOGY

Toxicology of the microbial insecticide, thuricide, by Fisher, R. and Rosner, L., *J. agric. Fd. Chem.*, 1959, 7 (10), 686.—One of the advantages of the new living insecticide based on the viable spores of the microorganism *Bacillus thuringiensis* Berliner is its nontoxic nature for man, other animals, and plants. This characteristic was firmly established in a series of tests which included an unusual human volunteer test. The toxicology studies described in this paper represented a pioneering effort, as there was no precedent to guide the manufacturer or government officials in establishing that the proposed use of the pesticide would be without hazard to health.

Mycological formation of fat. VII.—Formation of fat from molasses by *Aspergillus nidulans* and by *Penicillium soppii* in surface culture and in shaken culture, by Gad, A. M., Murray, S. and Walker, T. K., *J. Sci. Fd. Agric.*, 1959, 10 (11), 597.—Experiments have been made with cane molas-

ses and with beet molasses as substrates for the cultivation of the fat-producing moulds *Aspergillus nidulans* and *Penicillium soppii*. Satisfactory yields of fat up to 16 g. per litre on a cane molasses medium supplemented with salts and up to 11.8 g./l. on an unsupplemented beet molasses medium were obtained with *A. nidulans* in static culture, but in shaken cultures prepared with molasses media this mould produced little fat. In static and in shaken cultures prepared with sucrose-salts media *P. soppii* produced 21.6 g. of fat/l. and 8.1 g. of fat/l. respectively. In static cultures on supplemented and unsupplemented cane-molasses media *P. soppii* produced about 18 g. of fat/l., while in static cultures on beet molasses media, whether fortified by salts or not, the yield was 22 g./l. When *P. soppii* was grown in beet molasses media with agitation the highest yield of fat was 6.2 g./l.

Use of antibiotics in media for assessing bacterial contamination in food yeast, by Fleming, M. Barnard, N. H. and Allen, J. A., *J. Sci. Fd. Agric.*, 1959, 10 (12), 651. A selective medium was required which would permit accurate enumeration of bacterial contaminants in an actively growing culture of food yeast (taken, for example, from a fermenter). The necessary criteria were that the medium should allow unrestricted growth of species of bacteria likely to be encountered as contaminants in factory conditions, and that the growth of food yeasts should be inhibited by low concentrations of the antibiotic. These criteria were fulfilled by a basal medium of tryptone-Yeastrel-glucose agar in which was incorporated one of the following antibio-

tics in the concentration indicated: candicidin, filipin, fungichromin or rimocidin (5 p.p.m.) or nystatin (15 p.p.m.).

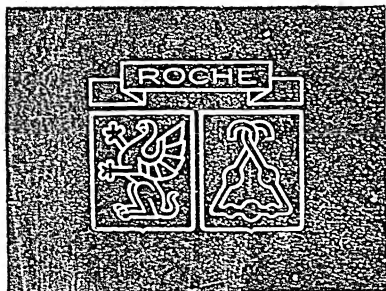
PACKAGING

Use of flexible packaging materials and inert gas to increase the shelf-life of food products, by Gross, G. B., *Food Technol.*, 1959, 13 (11), 621.—Generally speaking, products high in fats and oils which are subject to oxidation, can become rancid with all the associated undesirable characteristics, unless provisions are made to remove atmospheric oxygen and replace it with inert gas investigations have shown that when products are packaged in a nitrogen atmosphere their shelf-life is extended considerably. The packaging material for flexible gas packaging is one that has zero gas permeability and is readily machineable so that it can be converted into a hermetically sealed package. The choice of basic materials and subsequent laminations in individual cases is influenced by the protection factors that may be required. These include such factors as moisture vapor protection, possible chemical reaction between certain foods and the packaging material or vice versa, merchandising concepts, machineability in the convertor and food processor plants, and adaptability to packaging equipment and cost. In order to achieve a successful gas package, manufacturers of packaging equipment have modified their existing machines to incorporate inert gas into the formed package. Powdered products are usually packaged on a so-called form fill and seal machine operating either horizontally or vertically.

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C.F.T.R.I. PUBLICATIONS

1. SOME ASPECTS OF FOOD TECHNOLOGY IN INDIA (*published in August 1959*), pp. 160.

This is a publication specially brought out on the occasion of the F.A.O. Regional Seminar on Food Technology for Asia and the Far East held in Mysore from August 1-8, 1959. It is a collection of 26 review articles, which cover exhaustively the research work done in India on some of the important aspects of Food Science and Technology, particularly those dealing with rice and rice substitutes; fruit and vegetable products; dehydration of foods; storage, packaging and transport of perishables; infant, invalid and protein-rich foods; beverages, spices and condiments; etc. The book represents under one cover the important lines of work and progress made in India in the field of Food Technology.

Price: (Bound) Rs. 10.00 (*postage extra*); £1.5.0; \$ 4.00.

(Ordinary) Rs. 5.00 (, ,); £0.12.0; \$ 2.00.

2. FRUIT AND VEGETABLE PRESERVATION INDUSTRY IN INDIA (*published in May 1956*) pp. xiv + 485. (Compiled and edited by R. C. BHUTIANI).

This publication is packed with up-to-date technical and statistical data on several aspects of the Fruit and Vegetable Preservation Industry spread over 65 papers read and presented by scientists, technologists, industrialists (manufacturers of food products, machinery, additives, containers and packaging) as well as importers and exporters. Some papers also bring out adequately the various stages of development of the Industry in the country and the handicaps with which it is faced today. The inclusion of the discussions which followed each of the papers read, has added to the usefulness of the book. It also contains the Recommendations of the Symposium submitted to the Planning Commission for consideration in respect of schemes to be included in the Second Five-Year Plan.

Price: Indian, Rs. 6.00 (*postage extra*); Foreign, 15 shillings; \$ 2.50

3. TECHNICAL AID TO FOOD INDUSTRIES (*published in July 1954*), pp. xvi + 270.

This publication, contains the views and suggestions of prominent scientists, leading industrialists and food technologists, and Government officials on the nature of technical aid needed by different food industries in the country. Up-to-date technical and statistical data are provided and an appendix embodying the conclusions of the Symposium as well as a comprehensive index are given.

Price: Indian, Rs. 5.00 (*postage extra*); Foreign, 10 shillings; \$ 1.75

4. FOOD AND POPULATION AND DEVELOPMENT OF FOOD INDUSTRIES IN INDIA (*published in July 1952*) pp. xv + 357.

This book brings together the views and suggestions of leading thinkers, industrialists, scientists, demographers and other experts on the two topics. Packed with up-to-date technical and statistical data on several food industries such as fruit preservation, biscuit, chocolate, confectionery, glucose, flour-milling, food yeast, vanaspati, edible oils, fish processing, food machinery and the refrigerated preservation of perishable foods, this authoritative document brings into relief the handicaps and potentialities of these Industries in India. An appendix embodying the recommendations of a Committee of Experts, and a comprehensive index enhance the usefulness of the book.

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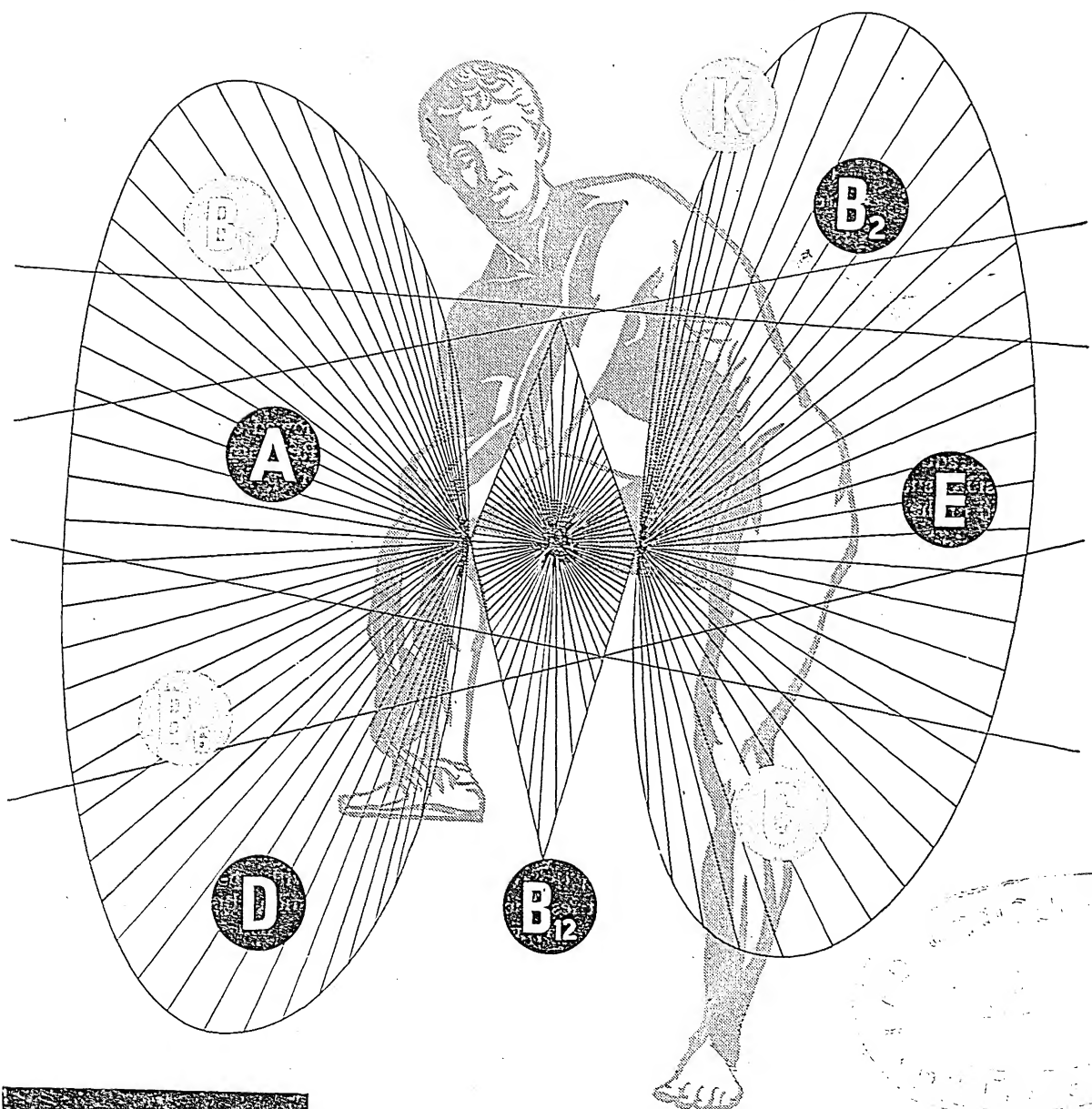
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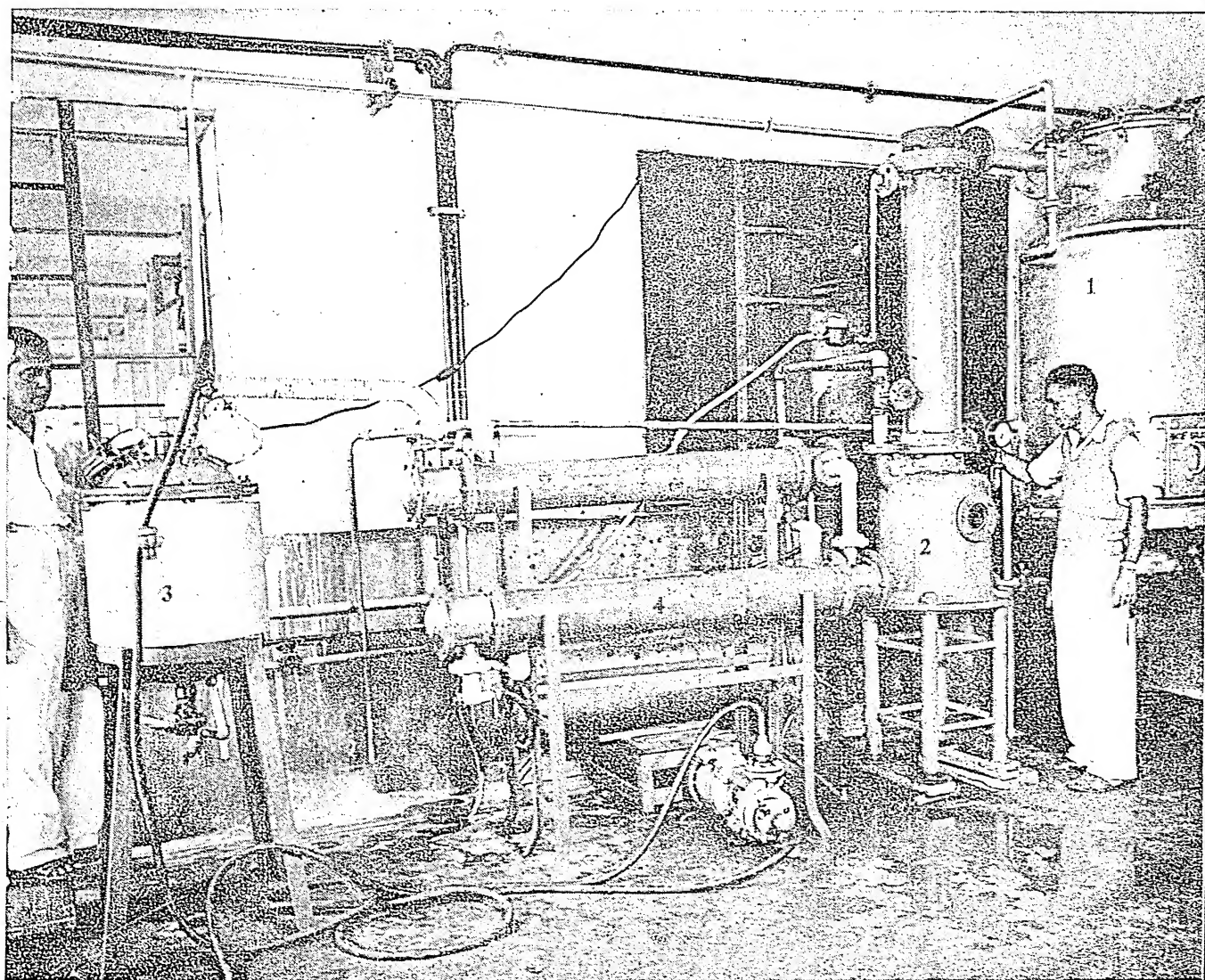
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SYMPOSIUM ON "PROTEINS"

DR. V. SUBRAHMANYAN, Director, Central Food Technological Research Institute, Mysore and *Convener of the Symposium*, in a second circular, has brought to the notice of all concerned that the above Symposium will be held *during August 14-16* under the joint auspices of the *C.S.I.R. Chemical Research Committee* and the *Society of Biological Chemists (India)*. PROF. M. S. THACKER, Director-General of Scientific and Industrial Research, will inaugurate the Symposium on August 14 (A.N.) and SHRI B. D. JATTI, Chief Minister of Mysore, will preside. The main sessions of the Symposium will be held on August 15 and 16. The detailed programme of the Symposium is under preparation and will soon be communicated to the participants along with the abstracts of papers received. Those who have not already sent their *contributions* and intend reading a paper, could send the same to DR. A. SREENIVASAN together with an abstract thereof *immediately* and in any case not later than July 15. It is also expected that the organizers of the Symposium will be able to arrange a display of institutional and industrial *exhibits* relating to proteins and their utilization. The detailed papers along with the proceedings will be published in a book form soon after the Symposium. Particulars relating to some important hotels and guest houses in Mysore catering to different types of tastes, have been provided in the circular and for further information and correspondence concerning accommodation facilities, the participants have been requested to write to SHRI R. C. BHUTANI of the Institute.

—EDITOR

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SUITABILITY OF DIFFERENT VARIETIES OF MANGOES FOR THE PREPARATION OF MANGO CEREAL FLAKES

By GIRDHARI LAL, G. V. KRISHNAMURTHY, N. L. JAIN AND B. S. BHATIA

(Central Food Technological Research Institute, Mysore)

The preparation and uses of nutritious and highly acceptable mango cereal flakes have been reported earlier¹⁻³. Although more than 500 varieties of mangoes are available in the country, only certain varieties are commercially important based upon their yield, flavour and taste. As the quality of flakes is mainly dependent on the colour and flavour of the pulp from which they are prepared, it was considered desirable to carry out trials with some of the varieties of mangoes grown in important mango growing areas of the country, to determine their suitability for the manufacture of flakes. Five South Indian varieties, *viz.*, *Badami*, *Raspuri*, *Totapuri*, *Neelam* and *Padri* and three U.P. varieties, *viz.*, *Safeda* (Malihabad), *Safeda* (Lucknow) and *Dusehri* were taken for this study.

Experimental

Pulp was prepared from fully ripe fruits of the above five South Indian varieties, canned in A_{2½} size cans by conventional method and

stored at 35-45° F till used for the preparation of flakes. The pulps of the three U.P. varieties were obtained from the Fruit Utilization Laboratories, Lucknow, in A_{2½} size cans, as processed canned pulp.

Flakes were prepared by the procedure described by Jain *et al*³, using the following recipe:

	lbs	oz
Mango pulp ...	100	0
Maida (wheat flour) ...	10	4
Glucose ...	5	11
Sugar ...	5	11
Calcium carbonate ...	46	grams
Sodium bicarbonate ...	91*	"
Pectin (slow set) ...	27	"

* Or sufficient quantity to raise the pH of the pulp to 5.00.

The above formula has been standardized with a pulp of about 18° Brix. In the case of pulp of lower Brix, more cane-sugar was added to raise it to 18° and where pulp of higher Brix was used, the amount of added cane-sugar was reduced accordingly. Mango pulp adjusted to pH 5.0 with the addition of calcium carbonate and sodium bicarbonate, was heated to 80-85°C and quickly added to the Maida paste which was separately cooked into a paste with thrice its weight of water to a temperature of 75-80°C for 2 minutes. The heating of the mixture was continued to a temperature of 80-85°C. Other ingredients and additives (like ascorbic acid) were then mixed with the cooked mass and the mixture was passed through a homogenizer to get a uniform homogenous mix. Pectin was added in the form of 2-3 per cent solution in water. The dough was dried into flakes in a double drum drier at a steam pressure of about 60 lb sq. inch. with a clearance of 0.014" between the two drums which were revolving at the rate of 2 to 3 r.p.m. Long sheets thus obtained, were broken by hand into small pieces, packed in friction top tins and

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TABLE I. *Composition and quality of pulps and cereal flakes prepared from different varieties of mangoes*

Variety	MANGO PULP								MANGO CEREAL FLAKES			
	Soluble Solids% at 20°C	Moisture%	pH	β -carotene mcg. per 100g.	Glucose%	Fructose%	Sucrose%	Colour	Moisture%	β -carotene mcg./100g.	Colour	Flavour
A. S.I. Varieties												
1. Badami ...	18.32	80.68	4.01	5,616	3.10	4.83	8.51	Orange yellow	1.59	9,488	Bright orange yellow	Strong mango flavour
2. Raspuri ...	17.31	82.06	3.99	3,861	2.34	3.84	9.62	Yellow	1.48	6,512	Slight dull yellow	Mild flavour
3. Totapuri ...	16.31	83.02	4.20	1,831	1.69	3.99	8.88	Very light yellow	1.99	3,805	Very dull yellow	Very mild flavour
4. Neelam ...	17.31	81.10	4.04	2,081	2.21	4.78	6.67	Orange yellow	2.72	5,509	Orange yellow	Slightly milder
5. Padri ...	19.32	79.54	3.92	4,698	1.00	2.57	12.30	Orange yellow	2.23	7,962	Bright orange yellow	Slightly marked
6. Badami-Raspuri (2:1) ...	18.02	81.14	4.00	5,014	2.85	4.50	8.88	Orange yellow	2.02	8,048	Orange yellow	Marked flavour
B. U.P. Varieties												
1. Safeda (Malihabad)	22.83	75.43	4.28	2,096	4.32	2.30	10.30	Orange yellow	2.47	4,000	Orange yellow	Mild flavour
2. Safeda (Lucknow)	20.32	78.63	4.30	1,183	3.41	2.64	9.26	Dull yellow	2.32	2,572	Dull yellow	Very mild flavour
3. Dusehri ...	20.82	78.00	4.60	2,297	1.91	3.64	12.58	Orange yellow	2.04	4,969	Orange yellow	Marked mango flavour
4. Safeda (Lucknow) —Dusheri (2:1)...	20.52	78.42	4.40	1,554	2.91	2.97	10.37	Light orange yellow	2.09	2,899	Orange yellow	Marked mango flavour

waxed. Where necessary, the pieces were dried for 30 to 60 minutes in a cross flow hot air drier at 50°C in order to reduce the moisture content to about 2 per cent before packing.

Carotene and ascorbic acid were determined by the official methods of the Association of Vitamin Chemists⁴, sugars by Tings's⁵ colorimetric method and other constituents by A.O.A.C. methods for plant materials. Colour and flavour of the products were evaluated organoleptically. The hygroscopicity of flakes was determined by exposing 10g. of the material in a Petri dish to the atmosphere and weighing at half hour intervals.

Results and Discussion

The composition and quality of mango pulps and cereal flakes prepared from the above eight varieties are given in Table I.

Pulps: Among the South Indian varieties, pulp of *Badami* mangoes was the richest source of β -carotene, had orange yellow colour and best flavour. Though pulps of *Padri*, *Neelam* and *Raspuri* mangoes had attractive colour, they had comparatively milder flavour. *Totapuri* variety was poor in β -carotene, colour and flavour. Of the U.P. varieties, *Dusehri* pulp had maximum orange yellow colour and flavour, followed by *Safeda* (Malihabad). *Safeda* (Lucknow) was poor both in colour and flavour.

Ascorbic acid content of all these pulps was low (11.2 to 19.3 mg/100g) which was almost completely destroyed during the preparation of flakes. Therefore, synthetic ascorbic acid was added to the dough (50 mg/100g.) just before drying into flakes. Vitamin C in the final product varied between 145 to 155 mg/100g.

Flakes: Flakes prepared from *Badami* pulp had maximum orange yellow colour and flavour whereas *Padri* and *Neelam* varieties yielded products with attractive colour but had rather mild flavour. Flakes from *Raspuri* variety were slightly dull yellow in colour but had satisfactory flavour. Flakes from *Totapuri* variety had very light yellow colour and poor flavour. Amongst U.P. varieties, flakes from *Dusehri* pulp had maximum orange yellow colour and flavour followed by *Safeda* (Malihabad). Flakes from *Safeda* (Lucknow) variety had dull yellow colour and mild flavour.

Data regarding hygroscopicity of flakes prepared from these pulps is given in Table II which shows that the hygroscopicity of flakes increased with increasing fructose content (Table I) of the pulp. Of the S. Indian varieties, in spite of their excellent colour and flavour, flakes from *Badami* pulp were the most hygroscopic and those from *Padri* pulp the least. Amongst the U.P. varieties flakes from *Dusehri* pulp were found to be more hygroscopic than others.

TABLE II. Moisture uptake of flakes from different varieties of mangoes, when exposed to air at 28°C and 60% R.H.

Variety	Moisture uptake by 100 g. of flakes			
	½ Hour	1 Hour	1½ Hours	2 Hours
<i>Badami</i> ...	1.09	2.12	3.05	3.75
<i>Raspuri</i> ...	0.78	1.55	2.20	2.76
<i>Totapuri</i> ...	0.88	1.86	2.64	3.28
<i>Neelam</i> ...	0.91	1.99	2.85	3.61
<i>Padri</i> ...	0.66	1.31	1.85	2.28
<i>Badami-Raspuri</i> (2:1)	0.98	1.92	2.76	3.42
<i>Safeda</i> (Malihabad)	0.64	1.28	1.81	2.21
<i>Safeda</i> (Lucknow) ...	0.67	1.34	1.90	2.34
<i>Dusehri</i> ...	0.77	1.55	2.24	2.82
<i>Safeda</i> (Lucknow) <i>Dusehri</i> (2:1) ...	0.69	1.44	2.11	2.65

The above observations indicated that pulps of *Badami* and *Dusehri* varieties, by themselves, were suitable for the preparation of flakes, but the flakes prepared from other varieties were not fully satisfactory as they lacked either in flavour (*Safeda* (Malihabad), *Raspuri*, *Neelam* and *Padri*) or both in flavour and colour (*Safeda* (Lucknow) and *Totapuri*). In view of their commercial importance, it is necessary to exploit these varieties for the manufacture of flakes of suitable qua-

lity. It was found that a pulp of poor flavour and dull colour when blended with another pulp of bright colour and strong flavour, yielded flakes which were very much superior to the flakes prepared from the former pulps alone. Thus, flakes prepared from blended pulps of *Badami* and *Raspuri*, *Badami* and *Totapuri*, and *Safeda* (Lucknow) and *Dusehri*, in the ratio of 2:1 were superior to flakes prepared from pulps of *Raspuri*, *Totapuri* and *Safeda* (Lucknow) varieties alone.

The proximate, mineral and vitamin composition of a typical sample of flakes prepared from the blended pulps of *Badami* and *Raspuri* (2:1) is as follows:

Moisture—2.21 per cent; ash 1.62 per cent; protein—3.85 per cent; reducing sugars—32.8 per cent; sucrose—39.7 per cent; starch—17.9 per cent; crude fibre—1.56 per cent; calcium—115 mg. per cent; phosphorus—50 mg. per cent; iron 7 mg. per cent; ascorbic acid—150 mg. per cent and β -carotene—7.2 mg. per cent.

Summary

An investigation on the determination of suitability of different varieties for the preparation of mango cereal flakes has shown that the best quality flakes, could be prepared from (i) *Badami* mango pulp, (ii) *Badami* mango pulp blended with *Raspuri*, *Totapuri*, *Neelam* or *Padri* mango pulps in the ratio of 2:1; (iii) *Dusehri* mango pulp (iv) *Dusehri* mango pulp blended with *Safeda* (Lucknow or Malihabad) pulp in the ratio of 1:2. Hygroscopicity of flakes increased with increasing fructose content of pulps. Flakes from *Badami* mango pulp were most hygroscopic. Proximate, mineral and vitamin composition of a typical sample of flakes shows that they are a rich source of carbohydrates, minerals, ascorbic acid and β -carotene.

Acknowledgement

We offer our grateful thanks to Dr V. Subrahmanyam, Director, for his keen interest in this investigation.

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STUDIES IN NON-ENZYMATIC BROWNING IN FOODS—THE MECHANISM OF SUGAR-ORGANIC ACID SYSTEM

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Non-enzymatic browning has been studied by several workers, but the importance of sugar-organic acid systems has been shown only recently. The work of Haas and Stadtmann¹, Lewis *et al.*², Livingston *et al.*^{3,4,5}, has laid stress on the pH of the system. Kapur *et al.*⁶ have shown that not only the hydrogen ion concentrations but also the nature of the sugar or acid plays an important role.

The present investigation deals with the role of concentration and molecular proportions on the non-enzymatic browning.

Experimental

One sugar, sucrose, and one acid, citric acid, which are present in most of the fruit products were selected in twelve varying proportions of sucrose and citric acid. The solution of pure and mixed systems were refluxed under exactly the same conditions using a constant temperature bath and the samples were drawn at intervals of 2 hours upto 10 hours of refluxing. The pH, titrable acidity, optical density at 420, 490 and 530 m μ and optical density at peak positions in the region 250-300 m μ of these solutions were taken. The results are recorded in Table I-III.

TABLE IA. pH changes in sucrose + citric acid systems after refluxing decimolar solution

Ratio sucrose + citric acid	Time in hours (refluxed)					
	0	2	4	6	8	10
1:1	...	2.68	2.57	2.60	2.50	2.50
1:2	...	2.62	2.48	2.52	2.46	2.43
1:3	...	2.50	2.48	2.52	2.37	2.34
1:5	...	2.42	2.47	2.52	2.36	2.32
1:10	...	2.42	2.44	2.52	2.36	2.30
2:1	...	2.58	2.62	2.66	2.50	2.48
3:1	...	2.66	2.66	2.64	2.60	2.52
5:1	...	2.74	2.82	2.84	2.70	2.65
10:1	...	2.57	2.93	2.94	2.81	2.77
Sucrose alone	...	4.54	4.18	4.16	3.74	3.88

TABLE IB. pH changes in sucrose + citric acid systems after refluxing molar solution

Ratio sucrose + citric acid	Time in hours (refluxed)					
	0	2	4	6	8	10
1:1	...	2.60	2.08	2.12	1.92	1.81
1:2	1.90	2.10	1.85	1.72
1:3	...	2.16	1.86	2.06	1.80	1.70
1:5	...	2.04	1.86	1.94	1.78	1.64
1:10	...	1.95	1.92	1.94	1.78	1.64
2:1	...	2.07	1.92	2.22	1.99	1.82
3:1	...	2.72	2.10	2.13	2.22	2.08
5:1	...	2.74	2.34	2.24	2.28	2.14
10:1	...	2.88	2.44	2.34	2.49	2.08
Sucrose alone	4.70	3.52	4.32	4.04	3.60	3.52
Citric acid alone	1.88	1.80	1.78	1.78	1.70	1.65

TABLE II. Browning in sugar of organic acid system. (sucrose and citric acid of molar strength)

Ratio	2 hrs.	4 hrs.	6 hrs.	8 hrs.	10 hrs.
Optical density at wave length 420					
1:1	0.53	1.56	2.28	3.45	2.16
1:2	...	1.35	2.16	3.60	1.92
1:3	0.54	1.35	1.86	2.85	1.86
1:5	0.56	1.38	1.98	2.22	1.88
1:10	0.32	0.69	0.99	1.35	1.11
2:1	0.39	1.23	2.04	2.85	2.73
3:1	0.47	1.29	2.04	2.40	1.86
5:1	0.23	0.75	1.23	1.86	1.47
10:1	0.29	0.96	1.56	2.28	2.22
Sucrose alone	...	0.21	0.33	0.51	0.53
Citric acid alone	...	0.27	0.05	0.15	...
Optical density at wave length 490					
1:1	0.21	0.59	0.87	1.74	0.66
1:2	...	0.50	0.93	1.56	0.56
1:3	0.18	0.53	0.63	1.32	0.54
1:5	0.14	0.47	0.69	0.57	0.44
1:10	0.12	0.24	0.36	0.47	0.36
2:1	0.12	0.41	0.72	0.96	0.84
3:1	0.12	0.41	0.72	0.78	0.50
5:1	0.06	0.23	0.39	0.66	0.39
10:1	0.06	0.30	0.48	0.78	0.63
Sucrose alone	...	0.09	0.12	0.18	0.17
Citric acid alone	...	0.09	0.03	0.06	...

TABLE II—*Contd.*

Ratio	2 hrs.	4 hrs.	6 hrs.	8 hrs.	10 hrs.
<i>Optical density at wave length 530</i>					
1:1	0.11	0.48	0.72	1.44	0.51
1:2	0.42	0.78	1.62	0.44	...
1:3	0.14	0.45	0.54	1.14	0.42
1:5	0.18	0.57	0.84	0.72	0.56
1:10	0.11	0.21	0.30	0.39	0.29
2:1	0.06	0.33	0.59	0.75	0.66
3:1	0.38	0.38	0.60	0.63	0.38
5:1	0.02	0.17	0.30	0.51	0.30
10:1	0.06	0.24	0.36	0.60	0.47
Sucrose alone	...	0.09	0.09	0.18	0.15
Citric acid alone	...	0.03	0.03	0.06	...

The results were almost similar with molar solutions also.

Browning: Table II records the optical density of brown solutions (molar) measured at 3 wave lengths in the visible region. The optical density was maximum at the lowest wave length viz., 420 $m\mu$ and least at the highest wave length, 530 $m\mu$. The optical density at all wave length under all proportions increased to a maximum upto 8 hours of refluxing and then dropped down invariably in all cases with 10 hours of refluxing. Browning generally decreased with the increasing proportions of acid concentration practically at all wave lengths with a few exceptions which may be only an experimental error. This held good also in

TABLE III. *Position of the ultraviolet peak and optical density at peak position of different proportions of sucrose-citric acid (molar and decimolar) after 2, 4, 6, 8 and 10 hours refluxing*

TIME	Proportions																Sugar alone				
	1:1		1:2		1:3		1:5		1:10		2:1		3:1		5:1		10:1				
		O.D.		O.D.		O.D.		O.D.		O.D.		O.D.		O.D.		O.D.		O.D.		O.D.	
<i>Decimolar</i>																					
2 hrs	...	282	0.35	28	0.29	275	0.23	282	0.26	275	0.23	No		No		No		No			
10 hrs*	...	260	1.15	26	2.00	270	0.42	270	0.88	...	...	250	2.15	260	1.65	260	1.80	260	2.5	No	...
<i>Molar</i>																					
2 hrs	...	260	1.59	...	...	260	1.13	260	1.05	260	1.20	260	1.23	260	1.51	260	0.98	260	1.22	No	...
4 hrs	...	260	1.42	260	0.22	260	1.14	255	1.11	258	0.63	255	1.34	255	1.54	255	1.26	255	1.37	No	...
6 hrs	...	255	1.11	255	1.28	260	1.61	258	0.33	No	...	255	0.75	...	...	...	...	255	0.46	No	...
8 hrs	...	258	0.68	258	0.64	258	0.52	258	0.39	275	0.10	260	0.98	260	0.70	258	0.35	258	0.53	No	...
10 hrs	...	258	0.78	260	0.58	260	0.47	260	0.31	270	0.11	255	1.30	260	0.46	260	0.73	No	...	No	...

* The observations were taken after 4, 6 and 8 hours, but no peak was indicated in the region 250-300 so they are omitted from the Table.

Discussion

pH: From Table I A, it will be seen that the pH of the solution containing decimolar concentration of sugar and citric acid decreased from 2.68 to 2.50 in the course of 10 hours of refluxing. It is also clear that when the proportion of acid to sugar was increased, the drop in pH also increased. With the increasing proportions of sugar to acid however, the drop in pH decreased.

the case of increasing proportions of sugar except in case of 10:1 wherein browning was invariably more than that in 5:1. From these observations it can be concluded that the browning reaches its maximum after 8 hours of refluxing after which it starts decreasing in the solution and a precipitate appears which does not indicate absorption in the clear solution. Another important inference is that for maximum browning there should be

equimolecular proportions of sugar and acid. Any increase in the concentration of either of the reactants throws the equilibrium in the backward direction. The decimolar solutions do not show appreciable browning.

Ultraviolet absorption spectra. By a study of Table III (decimolar solutions) it can be seen that after 2 hours, the position of the peak was in the region 275-285 m μ indicating furfural or HMF. It disappeared afterwards and reappeared again after 10 hours, in the position 260-270 m μ probably due to a shift in the conjugation on account of further break down. The increase in acidity supports the view that some acid is formed. Perhaps the nature of the compound had changed and the resultant peak shifted to 260 m μ . However, the peak which appeared in the case of decimolar solution after 10 hours of refluxing was evident even after 2 hours refluxing of the molar solution. Invariably this peak was in the region 255-365 m μ and may be due to some compound other than furfural or hydroxymethyl furfural. The optical density at peak position decreased (molar solutions) in most of the cases with increase in the time of refluxing. This fall in the optical density

was followed by a rise in optical density in the visible region. So it can be supposed that the brown precursor first formed gets transformed into brown soluble material and ultimately to brown pigment with the passage of time.

Summary

The pH of all solutions decreased with the period of heating. The fall was more in molar than in decimolar solutions. The lowering in pH was more with increasing acid ratios and less with increasing sugar ratios.

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EFFECT OF SUPPLEMENTARY PROTEIN FOOD BASED ON COCONUT MEAL, GROUNDNUT AND BENGALGRAM FLOURS ON THE GROWTH AND NUTRITIONAL STATUS OF CHILDREN

In a previous publication Subrahmanyam *et al*¹ reported that supplementation of the diets of children with 2 ounces daily of a low cost protein food (Indian multipurpose food) based on ground nut flour and Bengalgram flour brought about a marked improvement in their growth and nutritional status. In view of the wide prevalence of protein malnutrition among children in India, it has become a matter of urgent necessity to utilise other available protein rich oilseed meals as supplements to the diet^{2,3}. Coconut meal is one such as it is available in large quantities as a by-product of the oil industry in Kerala and other parts of South India. Coconut meal contains about 20-25 per cent protein of high biological

value but its high fibre content restricts its use as the sole protein supplement to human diets.⁴ In a recent publication Krishnamurthy *et al*.⁵ reported that a protein food based on a blend of coconut meal, groundnut flour and Bengalgram flour when incorporated at 12.5 per cent level in poor rice diet, supplemented to a marked extent the diet, as judged by the growth of rats. The present note gives an account of a feeding experiment carried out for assessing the effect of supplementing the diet with 2 ounces of a protein food based on a blend of coconut meal, groundnut flour and Bengalgram flour on the growth and nutritional status of school children.

The protein food used in this experiment was

prepared according to the method described by Krishnamurthy *et al.*⁶. The experiment was conducted in a local Muslim boys' boarding home. Forty boys aged between 7-12 years and free from diseases likely to interfere with the experiment were selected for the experiment. Initial height, weight, haemoglobin level, R.B.C. count and nutritional status of the boys were determined according to the methods described by Reddy *et al.*⁶. On the basis of the above data the children were paired and members of each pair allotted at random to two groups. The basal diet consumed by both the groups of children had the following average composition; Rice 238.0 g; white wheat flour 46.0 g; pulses (Bengalgram dhal and red gram dhal) 23.0 g; butter oil 15.2 g; skim milk powder 30.0 g; cheese 12.6 g; leafy vegetables 8.2 g; non-leafy vegetables (Brinjal, potato, knol khol etc.) 80.0 g; sugar 14.0 g; common salt 17.2 g; spices and condiments 11.0 g. The nutritive value of the basal diet calculated according to the figures given by Aykroyd *et al.*⁷ was as follows: Calories, 1715; protein, 44.2 g; fat, 24.5 g; carbohydrate, 330.1 g; calcium, 0.68 g; Phosphorus, 1.12 g; iron, 9.7 mg; vitamin A value, 963 I.U.; thiamine, 0.62 mg; riboflavin, 0.74 mg; nicotinic acid, 6.4 mg; ascorbic acid, 21.5 mg. The children in the experimental group received

two ounces of the protein food which provided the following quantities of different nutrients: protein, 19.9 g; calcium, 240 mg; phosphorus, 339 mg; thiamine, 0.8 mg; riboflavin, 1.75 mg; nicotinic acid, 6.1 mg; vitamin A, 1704 I.U. and vitamin D, 170 I.U.; and calories, 210. In order to equalise the calories in the two groups, each child in the control group received daily a pudding made from one ounce of corn starch and one ounce of sugar. The feeding was continued for 8 months at the end of which, height, weight, haemoglobin, R.B.C. count and nutritional status were again determined. All the children relished the protein food which was given in the form of a chutney and none complained of any digestive disturbance. The data obtained were subjected to statistical analysis and the results are given in Tables I and II. It will be seen from Table I that the average increase in height, weight, red blood cell count, haemoglobin level in the experimental group was greater than that observed in the control group, the differences being highly significant. Table II shows that 14 out of 20 boys in the experimental group showed an improvement in their nutritional status while none in the control group showed any improvement. On the other hand 3 boys in the control group showed deterioration in their nutritional status

TABLE I. *Average values of the initial and final measurements of children on rice and rice-protein food diets (20 children per group). Experimental period 8 months*

Character	Control group (rice diet)			Experimental group (rice-protein food diet)			Difference in the increase (experimental-control) with its standard error ³
	Initial	Final ¹	Increase ¹	Initial	Final ²	Increase ²	
Height (inches) ...	50.37	51.64	1.27	50.35	51.96	1.61	0.34 ± 0.11 ⁵
Weight (pounds) ...	52.78	54.03	1.25	53.18	56.49	3.31	2.06 ± 0.50 ⁶
Haemoglobin (g/100ml) ...	12.60	12.52	-0.08	12.28	12.97	0.69	0.77 ± 0.34 ⁴
Red blood cell count (106/cu. mm.) ...	4.24	4.16	-0.08	3.90	4.12	0.22	0.30 ± 0.07 ⁶

¹ One subject in the control group fell sick.

² One subject in the experimental group left the Institution in the middle of the experiments. The values for all the four characters for these two boys were estimated according to H. G. Cochran and G. M. Cox, "Experimental Design", pp. 99.

³ Standard error based on 17 degrees of freedom.

⁴ Significant at 5% level.

⁵ Significant at 1% level.

⁶ Significant at 0.1% level.

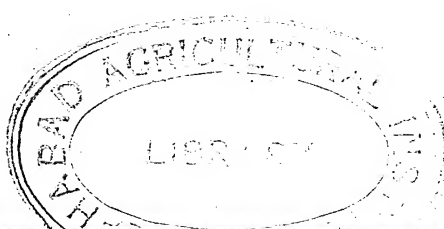


TABLE II. *Nutritional status of children on the rice and rice protein food diets (20 children per group)*

	Improved	Deteriorated	Stationary
Control group ...	...	3	17
Experimental group ...	14	...	6

while others remained stationary. The result obtained in the present investigation clearly indicate that large scale production and consumption of low cost protein foods based on blends of oilseed meals and pulses and fortified with vita-

mins and calcium salts will help to a considerable extent in overcoming the deficiencies in the diets of the low income groups of the population.

Our thanks are due to the authorities of the Muslim boys boarding home, Mysore for providing facilities for conducting the experiment and to Miss K. Indiramma for help in the statistical analysis of the results.

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EFFECT OF SUPPLEMENTARY PROTEIN FOOD BASED ON COCONUT MEAL, GROUNDNUT FLOUR AND BENGAL-GRAM FLOUR ON THE RETENTION OF NITROGEN, CALCIUM AND PHOSPHORUS IN CHILDREN

In an earlier publication from this laboratory Murthy *et al.*,¹ ported that undernourished children subsisting on an inadequate and ill balanced diet grew at a subnormal rate but maintained, on an average, slightly positive, nitrogen, calcium and phosphorus balances. Recently Subrahmanyam *et al.*² found that supplementation of the diet of similar undernourished children with 2 ozs of protein food containing coconut meal daily for a period of eight months produced a marked improvement in their growth and nutritional status. It was thought of interest to study the effect of the supplementary protein food on the metabolism of nitrogen, calcium and phosphorus. The results of such an investigation are given below:

The present investigation was carried out when the institution feeding experiment with the

protein food containing coconut meal had been in progress for a period of 3 months. Six pairs of children aged 10-12 years were selected from the control and experimental groups for the metabolism study. The boys in each pair were comparable in age, weight, height and nutritional status. Both the groups received a diet which on a daily average basis had the following composition. Rice 233 g.; whole wheat flour 44.7 g; pulses Bengalgram dhal (*Cicer arietinum*), and red gram dhal (*Cajanus cajan*) 22.2 g; butter oil 15.7 g; skim milk powder 30.5 g; cheese 12.8 g; leafy vegetables (amaranthus, mint and coriander) 7.9 g; non-leafy vegetables (brinjals, potato, knol khol etc.) 82.0 g; sugar 15.0 g; common salt 17.6 g; spices and condiments 10.4 g; Cheese, butter oil and skim milk powder were free gifts obtained by the orphanage from UNICEF and

TABLE I. Mean daily intake, excretion and balance of nitrogen, calcium and phosphorus of children on the rice diet and rice-protein food diet

Diet	Intake	Excretion			Balance
		Urinary	Faecal	Total	
<i>Nitrogen (g)</i>					
Rice (control) ¹	6.730	3.605	1.758	5.363	1.367
Rice + Protein food (containing coconut meal) (experimental) ²	9.942	5.596	2.223	7.819	2.123
Difference (experimental-control) ...	3.212	1.991	0.465	2.456	0.756 ⁴ ± 0.148 ⁴
<i>Calcium (mg)</i>					
Rice (control) ¹	613	41	317	358	255
Rice + Protein food (containing coconut meal) (experimental) ²	853	40	458	498	355
Difference (experimental-control) ...	240	-1	141	140	100 ⁴ ± 20 ³
<i>Phosphorus (mg)</i>					
Rice (control) ¹	1144	100	610	710	434
Rice + Protein food (containing coconut meal) (experimental) ²	1483	122	822	944	538 ⁶
Difference (experimental-control) ...	339	22	212	234	104 ⁵ ± 27 ³

¹ Calorie intake 1758.² Calorie intake 1741.³ Value with its standard error.⁴ Significant at 1% level.⁵ Significant at 5% level.⁶ Rounding off error.

are not normally consumed by the children. The experimental group received daily in addition to the above diet 2 oz., of the protein food containing coconut meal in the form of soup or chutney. Two ounces of this supplement provided the following nutrients: protein, 19.9 g; calcium, 240 mg; phosphorus, 339 mg; thiamine, 0.8 mg; riboflavin, 1.75 mg; nicotinic acid, 6.1 mg; vitamin A, 1704 I.U.; vitamin D, 170 I.U. and calories, 210. In order to equalise the calorie intake in the two groups each child in the control group was given daily pudding prepared from one ounce of corn starch and one ounce of sugar.

The diet, urine and faeces of the control and experimental groups were collected daily during a 5 day experimental period. The diet and excreta were preserved and analysed for nitrogen, calcium and phosphorus according to the methods described by Murthy *et al.*¹ The results obtained for the metabolism of nitrogen, calcium and phosphorus are given in Table I.

All the subjects in the control and experimental groups were in positive nitrogen, calcium and

phosphorus balances. All the subjects in the experimental group retained greater amounts of nitrogen, calcium and phosphorus than those in the control group. The results on statistical analysis showed that the difference between the experimental and the control groups in the nitrogen and calcium balances was significant at 1 per cent level and in the phosphorus balance at 5 per cent level.

Our thanks are due to Mr A. N. Sankaran and Miss K. Indiramma for the statistical analysis of the results.

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INSECT-RESISTANT PACKAGING

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The important role of adequate packaging in the national economy of the country need hardly be over-emphasised. The primary function of a package is to ensure that the product reaches the consumer in 'factory fresh' condition. Loss of food is mostly due to improper package and storage. In India food grain losses caused by insects and associated factors are estimated at between 2 and 3 million tons per annum¹. More than the half of the people of the world do not get enough food and the trends in the increased food production is not enough to keep pace with the increasing population. At the same time it is to be realised that efforts in the production of more food should be appropriately linked with the use of proper packaging and storage methods against insects, rodents and microbes. By adopting improved methods of storage, and adequate packaging there would be more food for the people.

It is the package which has to protect the contents from several hazards like insect infestation, vagaries of climate, transport, rough handling and conditions of storage. Satisfactory packaging of food products to protect them from insect infestation throughout their shelf life is more than an urgent necessity. The infestation of food packages by insects is a recurring problem for the processor of cereal products.

A complete understanding of how insects get into apparently tightly sealed package, where they come from, and how great would be the cost of insuring it against insect infestation are some of the points which require elucidation for developing insect-free-package.²

The prevention of insect attack on packaged foods has engaged the attention of several workers mainly by Parker (1913, 1915), Myers (1927), Stracener (1935), Hickin (1942). Most of the problems of insect infestation are experienced with foods that are packaged in flexible containers like, films, cartons, bags, envelops, packets and boxes of various sorts.

Importance of Insect-free packaging during world war

During the II world war the problem of protection of food packs against insects became acute, because rigid packaging materials were not available for packaging all commodities. Even to-day the problems are continuing because the use of flexible packaging materials are becoming popular on account of their cost and easy handling. In order to evaluate insect resistance of many flexible packaging materials, Essing of the University of California undertook a detailed study of the problem working on behalf of Quarter Master Corps of the U.S. Forces³. The study revealed that the main causes for the excessive losses of food were due to the insanitary methods of storage and transport, the vagaries of the climatic, and handling hazards, and above all the packaging material being not insect-proof.

In western countries, the problem of infestation of food by insects is not so acute as it is in India. According to Burton (the then President of Packaging Institute, New York) the infestation of packaged foods in U.S.A. is not very serious². This fact is due to lower-temperatures prevailing in those countries, better merchandising methods, quick turnover of the products and high degree of warehouse sanitation. Due to quick transport and marketing methods, the processed food reach the consumer in the shortest possible time so that, in addition the product being 'factory fresh', the insect eggs have no time to hatch or the larva might not have enough time to penetrate the package. These factors have greatly simplified the packaging practices in western countries.

Widespread occurrence of insects

In general the insects which infest stored food products are widely distributed because of their wide range of tolerance towards different temperature and humidity conditions. Some of the common insects which attack stored food products are: *Sitophilus granarius*(L), *Sitophilus oryza*(L),

Rhizopertha dominica(F), *Terebroides Mauritanicus*(L), *Oryzaephilus surinamensis*(L.), *Tribolium Confusum*(Duv.), *Stegobium panicum*, *Trogoderma sternale*, *Ephestia Kuhnii* (Zell.), *Plodia interpunctella* (Hbn.), and *Blattella germanica*. These insects thrive best in tropical and sub-tropical regions and such ideal conditions even in temperate countries, are to be found in side buildings and warehouses.⁴ Further, most of the species have a wide range of food habits. Many of them reproduce more or less continuously several generations in a relatively short period of time and many species are long lived. Certain female species will produce about 1,000 eggs within a period of 2 years which hatch in 5-12 days into larvae. Some species can survive in adult stage for long periods without food. Some species of insects remain undetected in the food material until larger populations have been built up.

How insect affects the package

Insects while penetrating the packages damage the packages impair moisture-proofness and gas-tightness of the package, reduce the overall strength of the package by developing weak points such as leakage, tearing, bursting etc. Further, they provide 'foci' for further infestation and make way for the entry of other insects, moulds, bacteria and all other types of external contamination.

Quite often some varieties of insects penetrate package irrespective of the fact whether the package provides suitable medium for their development. It has been shown that insects will attack packages left in the room even though unprotected food is available to them. Normally insects try to find their way into dark areas. Some of the insects bore holes merely as a habit because they 'enjoy' boring holes. Adult insects that invade food packages could flatten them-selves sufficiently to slip under folded ends to take part in the contents, lay eggs and then depart. These eggs would hatch and develop on the nutrients into strong and powerful larvae and in this process they eat up and destroy the packaging material^{5,6}.

Factors which influence insect penetration

Environmental factors of a package influence penetration by insects. The important factors favouring the penetration of packages by insects

are, temperature, moisture, humidity and nature of food. The temperature of the environment has a profound effect upon the activity of the insect. Most of the insects are not adapted to withstand low temperatures of 30° F to 40° F for prolonged periods. Optimum temperature for the activity and development of insects ranges between 70° F and 95° F. Temperature higher than 95° F has an adverse effect. In general the maximum penetration would be at between 75° F and 85° F. Relative humidity of the ambient atmosphere is an important factor. Generally, in humidities up to 85 to 90 per cent the package is more susceptible to damage by insects than in lower humidities. A dry environment is not quite favourable for the development of the insects and discourages penetration. Another aspect of environment is geographic or climatic condition in which the insect lives. For e.g. *Trogoderma granaria* is a serious pest in Gujarat district while it cannot thrive for long in Karnataka District⁷.

While the temperature, and humidity factors influence penetration of packaging films, the ability of the insect to penetrate packages depend upon the species and its life stage and to a large extent on the physical strength characteristics of the packaging material. Metallic packaging materials are practically resistant to insects. On the other hand packaging materials like wood, paper, plastics and the laminates are penetrated by insects to varying degrees. It may be of interest to state that even relatively strong packaging materials may provide places for insect attack at creases, scratches, folds, corners of the package. Polyethylene packages are generally resistant to insect penetration but the resistance of polyethylene film to insect penetration increases with increase in thickness of the film. Cellulose film does not offer protection from insects, irrespective of the thickness of the film. Lamination to plastic materials increases the resistance of some films. Tests conducted at Savannah indicate that lamination of some plastic films to kraft paper decreases their resistance to insect penetration. Among multiwall bags, Bemis bag was the most promising and this is quite common in Western countries but even this material is not so with

regard to *Tenebroides*. Some of the aluminium foil-film laminates have been found by Gerhardt and Lindgren to be relatively more resistant than transparent films. But they are not completely insect proof^{8,9,10}.

How package should be constructed

In the first instance the package should not carry any dormant infection and be composed of such materials which are safe against the invasion of insects. In addition there are a number of physical properties of packaging materials that influence the insect attack, like the smoothness or hardness of the surface and guage of the film used. The packages should be so fabricated without any openings through which the insect or its larva could enter. Obviously proper sealing of the packages assumes importance.^{11,12} Containers are to be constructed so that all parts fit perfectly with minimum length of seams and creases. While this is possible with films, foils and the laminates, packages made of textiles such as jute and cotton are not insect proof. Laminations of jute bags with plastic films, would make them relatively more resistant to insect attack and other climatic changes.

Control of insect infestation

The second aspect and equally important one is the warehouse sanitation. Efficient, adequate control of insect infestation will come only through a programme based on systematic examination and periodic surveys of conditions of insect attack. Then only it is possible for satisfactory packaging of food products to protect them from insects. In the control of infestation of packaged foods the co-operation of manufactures of packaging materials, carton makers, machine builders, adhesive manufacturers and production managers is very essential. The product and the packaging materials must be free from insects or their eggs or larvae, or excreta, and packaging must be conducted under sanitary conditions eliminating the possibility of infestation at the time of packaging. Fumigation in bulk or in package is considered advantages with dried fruits and nuts so that the latent infestation present in the material may be destroyed before storage. For other

products any other suitable method of killing the latent infestation could be adopted.

Trends in insect-proof packaging

It has already been emphasized that food products and food grain losses in India is great on account of insect infestation. So, packaging of food products free from insect infestation and contamination is an urgent necessity. Commonly the problem of insect infestation are with dried fruits, nuts, cereals and other food products which are generally packed in flexible containers. India has a good export trade in many commodities. Scientific packaging is essential so that commodities reach the consumer in overseas markets in good usable condition.

To save food from losses and damage by pests it necessitates a detailed understanding of various factors involved. Under conditions of improper handling even the best package may fail to provide the desired protection. Researches are under way in many parts of the world to improve the degree of protection to flexible containers. In order to develop an insect proof-package Essig suggests the incorporation of toxic or insect repellent chemicals into the packaging material^{13,14}. This offers a promising approach to the problem. Another line of effort is the development of suitable carton adhesive which has protective effect. Yet another line of attack of the problem is the development of multi-wall bag in which the outer layer is treated with insect poisons which would kill any insect which attack the package.

India exports dried fruits, spices and tobacco in sizable quantities. For example walnut which is produced in temperate regions has to pass through warmer and humid climatic conditions before reaching the consumer. The spoilage has been due to high temperature and humidity during transit. A detailed study undertaken by Murthy *et al* revealed that polyethylene film of 300 guage because of its insect and relatively moisture-proof properties and ameability to fumigation after packaging was found to be quite suitable material for packaging walnut kernels¹⁵.

Packages used for products like biscuits, breakfast foods like corn flakes, rolled oats, dried fruits and similar other products, should be adequate enough to give desired protection against weevil and mould attack and other undesirable changes like off-odour, rancidity and loss of crispness etc.^{16,17} These and similar problems do require attention and the remedy may largely lie in the use of suitable packaging materials.

Not much information is available about the insect resistance of various packaging materials produced and used under Indian climatic conditions. Work in progress at the Institute regarding the resistance of various packaging materials to insects that commonly infest food, reveals that even some of the commonly used packaging materials are not insect proof¹⁸.

Jute fabric for the packaging of bulk produce viz., cereals, cereal flours, sugar has long been in use in India. However, it suffers from a disadvantage of exposing the product to insect and rodent attack and climatic conditions. Earlier work by Pingale *et al.*^{19,20} at the central Food Technological Research Institute, Mysore, has shown that insect infestation can be effectively controlled by impregnation of jute fabric with insecticides.

Packaging of wheat flour, gram flour, spices and milled foods in jute bags is a problem, since jute fabric does not afford any protection against insects and other contamination. It has been shown by Iyengar *et al.*²¹ that laminated jute bags with polyethylene has the advantage in preventing external dirt, ingress of moisture, seepage of flour. By using impregnated jute bags with an inner lining of polyethylene film insect infestation could also be checked. Work is in progress regarding various other laminations for packaging a variety of products.

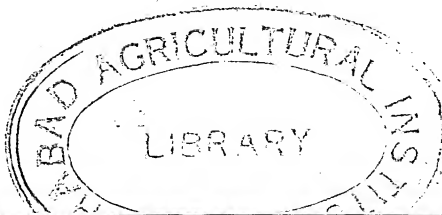
Thus in the development of an insect resistant package, several factors like, the nature of the product, the quality of the packaging

material and the several climatic and transport hazards the package is subjected, the methods of marketing prevailing in the area have all to be taken into account.

Further, insect-free packaging has certain economic advantages. It enhances sales, speaks good about the product, decreases the claims and materially benefits food processing firms whose goods have a moderate turnover. The warfare against insects appears to be endless and work on these and allied lines of packaging research will be of immense benefit to all concerned.

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Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during February—March 1960 are given in this section.

S (IS) 9

Some preliminary observations on gas storage of bananas, by N. S. Kapur (*February 25, 1960*).

—At the outset, the speaker said that the experimental work presented was carried out by him as well as by his colleagues and then described the fundamentals of gas storage or storage of commodity under modified atmosphere. Certain varieties respond to gas storage favourably while certain others develop injuries on account of the unusual atmosphere. A thorough investigation has, therefore, to be made into all the important varieties of fruits and vegetables. Dealing with the gas storage of bananas, the speaker said that banana is a very important commodity and its acreage is about 20 per cent of the total acreage under fruit cultivation. Initial work on the gas storage of Gros Michel bananas has been carried out by some workers and the speaker himself earlier had found that the gas storage of cavendish bananas was beneficial.

Describing the work done in the Institute, the speaker said that two varieties of bananas, freshly harvested, were given different treatments. Half the number of fruits were waxed and the other half kept as such. They were then stored under three gas concentrations, viz., 2.5 per cent, 5 per cent and 7.5 per cent of CO_2 and kept at two temperatures, viz., room temperature, 68–82° F (45–75 per cent R.H.) and 52–55° F (R.H. 90–95 per cent). The gas concentrations accrued by normal respiration was adjusted as desired. Periodical examinations (after three days in respect of those at room temperature and seven days in the case of those at low temperature) for P.L.W., respiration, mois-

ture content, acidity, ascorbic acid, reducing and non-reducing sugars, were carried out. Data for all the physico-chemical constituents were presented and discussed. It was found that the rate of respiration and loss in weight, were much reduced in gas stored bananas. The optimum storage life based on 10 per cent wastage was considerably prolonged. Gas storage showed a check on the increase of acidity.

The speaker concluded by saying that the observations definitely indicated that gas storage at room temperature as well as at low temperatures produced beneficial results, and that ripening of bananas was more uniform than that due to the conventional method of smoking. Further work on the elimination of volatiles and on the mechanism of the building up of sugars and acid during ripening would be carried out.

During the discussion that followed, some of the important points raised related to the organoleptic evaluation of gas-stored bananas, minimum time elapsed between harvest and gas storage, the number of bananas used in each trial, presence of maltose, rhamnose and other sugars in bananas, extent of the loss of ascorbic acid during gas storage, the effect of stomatal distribution of fruits on gas storage, possibility of trisaccharide being present along with the sugars found, reason for some varieties of bananas the peels of which do not change their colours during ripening, explanation for the accumulation of sucrose by hydrolysis of starch, nature of organic acids, whether mixtures of CO_2 , N_2 and O_2 have been tried for gas storage, extent of spoilage in gas stored bananas, etc.

The President in his concluding

remarks said that the stage of maturity for harvesting was an important factor. It is well known that bananas grown on hill slopes, have better storage life than those grown in water-logged places; similarly fruits with higher acidity keep much longer. The nature of skin changes during ripening has a bearing on the life of the fruits. If the optimum maturity of the unripe fruit for harvest is known and if the initial moisture content can be reduced before storage, much better results may be obtained. He said that the cooking variety of bananas and those which are economically important should be used for trials and their life extended by gas storage. He felt that the problem should be tackled with due reference to environmental factors. He observed that combination of gases and inclusion of some inert gas might be tried for gas storage of fruits.

S (IS) 10

Some aspects of quality in tea, by C. P. Natarajan (*March 14, 1960*).

—At the outset, the speaker detailed the various steps in the manufacture of black tea like picking, withering, rolling, fermentation, firing and grading and explained the changes taking place in each of the steps and their influence on the quality of made tea. Appearance, colour, strength, briskness, infusion flavour and quality are influenced by each one of the steps to varying degrees and hence the importance of control measures in the manufacture. Besides a proper control in manufacture, the important aspect to be considered is the inherent quality in the green leaf itself. Quality is made in the field first and the influence of weather, altitude,

bush characters, age of bush, method and length of plucking are all very important aspects of quality and no system of manufacture can produce a characteristic that is not already in the leaf. It is here that research is needed to know more about the precursors of quality in green leaf and how to retain them. Difficulties in interpreting cup tasters' terms with definite quality were pointed out.

In the examination of tea, the appearance of made tea and the infused tea are examined, for amount of stalk, fibre, degree of twist, colour and smell. The infused leaves are examined for uniformity of bright coppery colour. Greenness and dullness are not preferred.

In brew, colour, strength, pungency, flavour and creaming are examined. Colour and strength can be objectively measured. Creaming is a desirable attribute and is dependent on caffeine and polyphenol content. Aspects of flavour cannot be objectively assessed at present. We have to depend on cup tasters. However, attempts on aroma evaluation by gas chromatographic techniques are being made.

After detailing the various chemical constituents present in tea,

the author discussed in detail the role of polyphenols on quality of tea. Classification of brew on the basis of ethyl acetate-solubles (theaflavins) and ethyl acetate-insolubles (thearubigins) as advanced by Roberts, was described. Quantitative assessment of individual polyphenols like epigallo catechin gallate, epi-catechin gallate, epi-gallo catechin, gallo catechin, epi-catechin and catechin in green leaf have been made recently using cellulose column chromatography. Further work on made tea and brew are in progress in the Institute. The role of these polyphenols, their degradation products and their threshold concentrations in brew are all subjects of study which may throw some light on quality aspects.

After dealing with the various flavour constituents reported in tea, the current knowledge on the role of pectin degradation products and carotenoid degradation products on aroma were discussed.

Objective evaluation of quality is an important aspect of research, though a difficult one; yet a concentrated effort is essential. The possible approaches were pointed out and discussed. Studies on the nature of the quality constituents in green leaf, the role of polyphenols

and their degradation products, studies on the aromatic constituents finding out optimum taste threshold limits of each of the constituents, role of different waters in affecting the quality of brew, etc., were suggested as further approaches to the problem.

During discussion, points relating to packaging aspects of tea, differences between teas grown at high and low altitudes, influence of cultural factors on the quality of tea, relation between manganese salts and the colour of tea, influence of free amino acids on the flavour of tea, relation between the age of the leaves and the quality of tea, change occurring during fermentation, etc., were brought out.

In his concluding remarks, the President stressed the difficulties one has to face in such studies, the importance of concentrated effort and the necessity for objective evaluation of quality in tea. He also pointed out that the influence of every individual detail at different stages of manufacture on the quality of tea should be studied in collaboration with the tea taster. The possible role of trace elements in determining the flavour of tea was also worth studying.

Chewer's favourite

ASOKA SCENTED BETELNUT POWDER

Manufacturers: M. K. Krishna Chetty, Post Box No. 106, Coimbatore

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Protein deficiency

S (IS) 29

Kindly suggest to me a proper blend of cereal and pulses, which if consumed daily can overcome protein deficiency. (Pilibhit District).

The extent of protein deficiency has to be determined. For mild cases, it would be sufficient if rice or wheat together with pulses commonly used are consumed. It may be of advantage to take vegetables in plenty and milk to the extent possible.

For severe cases of protein deficiency, it is necessary to have details regarding the symptoms. A protein intake of at least 70 g. per day would be essential. It is difficult to obtain this level of protein intake by cereals and pulses as the protein content of these is not considerable. Multipurpose food (formula C) is the only food available with a concentrated source of protein (50 per cent). If this is used at 2-3 oz. level together with rice or wheat, pulses, vegetables and milk, it is easy to overcome even severe cases of protein malnutrition.

Protein deficiency is often aggravated by a combined vitamin deficiency. As multipurpose food contains also the vitamins, it is by far advantageous to use the MPF. Pea proteins are nutritionally superior to many other vegetable proteins. Digestibility of the proteins is a factor governing the availability of the constituent essential amino acids. Digestibility is likely to vary with individuals depending upon their conditions of health. Excessive consumption of fat particularly through fried foods should be avoided.

Loss of vitamins

E (IS) 30

What is the estimated loss of vitamins and minerals during the preparation of jams and pickles made of citrus fruits and those of Emblica officinalis particularly. (Pilibhit District).

The loss of vitamins in jams and pickles depends upon the method of preparation which varies widely from place to place and house to house. Unless the exact process employed is known, it may not be possible to give the extent of loss.

B-complex vitamins are comparatively more stable and generally the loss may be about 50 per cent. Vitamin C is susceptible to complete loss—the extent depending on temperature of heating, duration of heating, mode of heating and the nature of the vessel used for heating. Copper even in traces will account for the complete destruction of vitamin C.

Minerals are not generally subjected to serious losses.

Diet for diabetes

E (IS) 31

I learn that some work has been done in your Institute on the use of tender field beans in diabetic cases. Could you kindly furnish the details of the same? (Calcutta).

The consumption of tender field beans (*Dolichos lablab*) along with the diet helps to lower the blood sugar level in diabetics. This effect is not noticed with the mature field beans. The vernacular equivalents of field beans are as follows:

Hindustani	.....	'Val'
Tamil	.....	'Mochai'
Bengali	.....	'Sukno sim'

The tender field beans may be boiled and taken or cooked in the form of curry and consumed.

Consumption of 'idli' made from the fermented dough of 2 parts of rice flour and 1 part of blackgram flour also decreases to some extent the blood sugar level. Consumption of a lot of skim milk powder produces similar effect. However, it must be noted that these effects vary depending upon the diabetic condition which must first be tested by a doctor by doing, 'fast blood sugar test' and a 'glucose tolerance test'. If these are high, insulin must be taken on the doctor's advice but even here the above food suggested can bring down the requirements of insulin to a large extent. In some cases as previously reported, patient could get on with diet alone without insulin, but in any case, all this should be tried out under the expert supervision of a doctor. A close check on urinary excretion of sugar should also be kept.

Parboiling of paddy

E (BQ) 32

I have read the improved method of parboiling of paddy developed at your Institute and find that it is applicable for large scale trials in rice mills. I would therefore request you to intimate me the method that can be followed on home-scale for preparing parboiled rice. (North Kanara District).

The village method of making parboiled rice as is practised in many places gives a rice which is not smelling and is wholesome. This consists in raising water to boil in a big vessel, adding paddy to it and leaving it over without further heating for the next 12 hours or so.

The water is then drained out and the paddy allowed to dry in the shade and then milled. This gives sometimes some amount of broken rice as the parboiling is rather incomplete.

Another method that you can try is to soak the paddy in cold water for about 24 hours changing the soak water every 12 hours at least. The soaked paddy is then steamed; probably a big *idli* vessel that may be available in the house may be used. The paddy may also be kept in a bamboo basket which is supported in another bigger outer vessel in which water is boiled. The steaming is continued until the husk of the paddy splits. The paddy is then dried as usual and then milled. If you want to prepare fully parboiled rice without smell, the paddy is soaked in hot water (at 70° C) for 3-4 hours and the paddy is then steamed as suggested above. In the final stages of drying (if dried in the sun), one has to be a little careful as otherwise the broken rice might result. The paddy has to be turned over as frequently as possible to make for uniform drying.

Processing of dried peas

E (IS) 33

We are running a restaurant and want to use dried peas for our daily consumption. We are not interested in canning the peas for later use. We shall be obliged if you can kindly inform us a method for processing dried peas generally available on the market. (Delhi).

You can prepare processed peas daily for your hotel consumption without canning them. The under-mentioned details may please be followed:

(i) Shrinkled dried peas of telephone variety or any other suitable variety may be used for the purpose of preparing processed peas.

(ii) Soak the peas in water overnight.

(iii) Discard the spoiled peas by carefully sorting the soaked peas.

(iv) Boil the soaked peas in a pressure cooker at 10 pounds steam pressure for 30-40 minutes depending upon the extent of softness desired. Use equal quantity of peas and butter for boiling. Add 2 per cent salt and 4 per cent sugar to the boiling water and also a little quantity of colour. The colour can be prepared by mixing the undermentioned Edicol dyes which are easily available in the market:

Edicol-Supra Tatragin, N.S. (ICI)—60 parts and Indigo Carmine (E. Merck) N.S. (ICI)—40 parts or Blue VRS—1 part and Tatragin—5 parts.

Chewing vs nutrition

E (IS) 34

'Pan' leaves are grown in different parts of our country and widely consumed along with arecanut, etc., by the people. I would like to know whether any work has been done by you on the food value of betel leaves. What are the effects of chewing on the various systems of our body? Is it a fact that chewing of 'pan' leads to cancer? I shall deeply appreciate if you can kindly throw some light on the above points. (Bhagalpur District).

As regards chewing of pan, we have not done any specific work in this Institute but we intend taking

up some experiments in the near future. The information available from the literature and also gathered from practical experience is given below:

Chewing of betel leaves with arecanut and lime is an age-old practice. Chewing is known to stimulate the salivary and gastric secretions, thus aiding digestion. The chlorophyll and the essential oil present in the betel leaf and the added flavouring substances in the pan improve the mouth odour. Besides, chewing is a sort of exercise to the teeth and the muscles and the tannins of the arecanut strengthen the gums and preserve the teeth. The alkaloid, namely, 'arecoline' present in arecanut is well known to have strong pharmacological action and appears to act as a milk stimulant and aphrodisiac. The alkaloid along with the essential oil of the betel leaf is believed to tone up the general appearance.

As regards the relation between chewing of pansupari and nutrition, it is known that the habit of chewing betel leaves coated with slaked lime increases the intake of calcium in which the normal Indian diet is grossly deficient. The amount and utilisation of calcium ingested with six betel leaves has been found to be equivalent to that from 10 oz. of cow's milk. The composition of the raw and processed arecanuts, and of betel leaves are as follows:

Characteristics	Raw arecanut	Processed arecanut 'Kalipakku'	(Pan) Betel leaves
Moisture, %	31.30	13.80	85.40
Protein, %	4.90	6.40	3.10
Fat, %	4.40	8.40	0.80
Mineral matter, %	1.00	1.80	2.30
Fibre, %	11.20	11.80	2.30
Carbohydrates, %	47.20	57.80	6.10
Calcium, %	0.05	0.13	0.23
Phosphorus, %	0.13	0.14	0.04
Iron, mg %	0.50	11.10	5.70
Calorific value per 100g.	248	332	44
Carotene (in vitamin A-I.U. per 100g.).	5	—	9635

The above data indicates that arecanut and betel leaves are good sources of protein, carbohydrates, calcium, phosphorus and iron which are essential requirements for the growth of human body. They also supply vitamin A in fair amounts. Additional amounts of calcium are also supplied by the lime which is smeared on the betel leaves while chewing.

The misfeeling that generally exists among some people that chewing of pansupari is the primary cause of cancer of the mouth has been shown to be unfounded, by the statistical survey conducted for the incidence of cancer among the betel chewing natives of the South West Pacific Islands. Cancer might be caused by excessive chewing with tobacco but even here there is no conclusive evidence.

We have done some work on the preparation of a nectar from pansupari. The details of the method of preparation are given in the enclosed circular. This beverage incorporates in it all the constituents of *pan-beeda* and can serve as a substitute for chewing which has some disagreeable consequences such as spitting.

Annatto colour

E (IS) 35

We are interested in preparing annatto colour in solid form as a commercial venture and shall appreciate receiving details of the method thereof. (Bombay).

The method of preparation of annatto colour in dry form is as follows: For extracting the dye, the seeds are bruised and the pulp macerated with hot water in wooden vessels, and soaked in it for several days till the colouring matter forms a fine suspension. The seeds are then removed and the *berry* which contains the pigment is allowed to ferment for about a week. The dye,

annatto, that settles down at the bottom is separated and dried into cakes. The yield is 4.8-6 per cent by weight of the seeds. Another method consists in boiling the seeds with sodium carbonate solution, filtering and acidifying the filtrate. The dye is coagulated by boiling with common salt after which it is filter-pressed, washed and dried.

Preparation of peppermint and chocolates

E (IS) 36

I am desirous of making peppermints and chocolates on a small scale and would request you to inform me the details of their preparation as also the availability of necessary equipment. (South Kanara District).

We furnish the following for your information as desired by you.

PEPPERMINT. The machinery for the manufacture of this is too costly. Therefore it is advisable to produce on a small scale say about 2 cwt. per day. This can be done with less investment.

Process: Mix 100 lb. of icing sugar (finely powdered sugar) with 5 lb. of glue solution (0.5 lb. of edible glue in 5 lb. of hot water) for about 10 minutes. Then add sufficient edible liquid blue colour to the mix and again knead for a few minutes. Add about 3-4 oz. of peppermint oil followed by one pound of chalk powder (edible) and mix the mixture thoroughly until a fine and uniform dough is obtained. Make the dough by pressing into sheets of uniform thickness (generally 1/12" to 1/8") and then with the help of circular discs, peppermints are made just like the bakers make biscuits by hand. These are then dried in the sun or in drying rooms after spreading them in trays. The dried pepper-

mints are then packed in aluminium foils and stored.

The machine for the manufacture of peppermint is called Manesty Tablet Making Machine which consists of three units, namely, mixer, granulator and tablet presser. Such machines can be had from Messrs Kilburn and Co., Private Ltd., P.O. Box No. 1700, Madras or Messrs Larsen and Toubro, Ltd., P.B. No. 5247, 4-5, Club House Road, Madras 2.

CHOCOLATE. The recipe for chocolate is as follows:

Sugar	...	40 lb.
Liquid glucose	...	20 lb.
Cocoa powder	...	2 lb.
Butter or margarine	...	3 lb.
Condensed milk	...	5 lb.
Vanilla	...	0.5 lb.
Cream of Tartar	...	0.125 lb.
Cashewnuts	...	2 lb.
(Dessert grade)		

Procedure: Mix sugar and liquid glucose with a little quantity of water and start boiling the mixture for 10 minutes. Add condensed milk and butter and again allow it to boil. Then cocoa powder followed by cream of tartar is added, taking care to stir the boiling mass vigorously. When the mix has attained a thick consistency (resembles that of *Mysore pak*), add vanilla essence and cashewnuts (fried) and again boil for 2 minutes. The chocolate mix is removed from the oven and poured on a wide plate and spread to 1/2" thickness. The sheet thus obtained is cut into required sizes and allowed to cool completely. Then these pieces are wrapped first in tissue paper and then with aluminium foils and stored.

The machinery required for the large-scale manufacture of chocolates is very costly and you can enquire about the details of machinery and equipment, if desired, from the above mentioned two firms.

Notes and News

STATISTICAL NOTES

All-India Final Estimate of Kharif Pulses other than Tur, 1959-60.

Pulse	Area (thousand acres)		Production (thousand tons)	
	1959-60 Final estimate	1958-59 Partially revised estimate	1959-60 Final estimate	1958-59 Partially revised estimate
Urad ...	2,492	2,437	269	271
Mung† ...	3,102	2,987	279	258
Moth ...	3,928	3,779	277	306
Kulthi ...	3,294	3,396	313	322
Peas ...	13	13	2	2
Other pulses* ...	3,246	2,985	427	400
Total	16,075	15,597	1,567	1,559

*Includes also data on urad, mung, masur, etc., in respect of Bihar and Orissa for which separate figures are not available.

†Includes data for moth in respect of Madhya Pradesh and West Bengal.

(Economic and Statistical Adviser, Ministry of Food & Agriculture,
Government of India)

All-India Final Estimate of Groundnut, 1959-60

	1959-60 (Final estimate)	1958-59 (Partially revised estimate)
Area (thousand hectares)	6,194	5,898
Production (thousand metric tons of nuts in shell)	4,460	4,889

(Economic and Statistical Adviser, Ministry of Food and Agriculture,
Government of India)

NEWS BRIEFS

A new oil extraction process:

A simple and low cost process for the extraction of vegetable oils, particularly applicable to groundnuts has been developed at L' Institut des corps Gras of France. The advantages of the new process are: (1) very few operations are involved which affect the nature of the oil; and (2) fire hazards are eliminated since no volatile solvents are used, the only liquid used being water.

Groundnuts are shelled, milled and then crushed to such an extent that a part of the cells are opened

up, releasing oil and the nitrogenous matter. The crushed mass is suspended in water and stirred gently to form an emulsion which is centrifuged to separate the cake from the aqueous emulsion. The cake is processed further, being again put into suspension in water, passed through a homogenizer and then centrifuged once more; this process is repeated with progressively finer settings of the homogenizer until the whole of the oil is extracted from the cake.

The fat content of the emulsion is increased by means of a separator like the one used in dairying, when

a white cream is obtained. The cream is rendered slightly alkaline by adding sodium carbonate solution of pH 8.7, followed by treatment in a separator where, apart from the pure oil, a 'milk' containing the proteins in solution is obtained.

Surface-active agents are not necessary, since groundnuts contain sufficient water-soluble matter with emulsifying properties. The byproducts are the 'milk', the vegetable casein and the cake. The 'milk' can be processed to obtain a vegetable casein in powder form (*Res. & Ind.*, July 1959, p. 180).

Detection of adulteration of butter: For judging the purity of butter and other fatty substances, it is a common practice to determine certain index numbers and to compare them with those of genuine samples. If the two values differ substantially, adulteration is indicated. In the case of butter, however, the total volatile fatty acid content varies considerably from sample to sample, depending upon the origin of the milk. The conventional index numbers, therefore, do not give reliable results. It has been found that if the fatty acids isolated from a butter sample are distilled into two fractions of equal volume and their activities determined, the ratio between the acidities of the two fractions and the total acidity is constant. This ratio differs markedly for different fats. Based on this observation, a new method has been proposed for detecting adulteration of butter with other fats.

Method: A 5 g. sample of butter is saponified with 2 ml. of 50 per cent sodium hydroxide solution and 20 g. of glycerine, diluting the soap with 95 ml. of hot water and then breaking it down with 50 ml. of a 2.5 per cent solution of sulphuric acid. Pumice (0.5 g.) is added to the suspension which is then distilled in the same apparatus as that used for Reichert-Meissl

number determination. Two fractions, each 65 ml. in volume, are collected one after the other, adjusting the rate of heating in such a manner that the distillation lasts in all for 43 min. The two fractions are diluted first with 30 ml. of ethyl alcohol and then treated with 0.1 N solution of caustic soda.

The index is determined by dividing the volume of sodium hydroxide solution used up for titrating the first fraction by that used up for the second fraction. The ratio varies from 2.03 to 2.13 for genuine butter, but other fats give considerably lower values (cocoanut butter, 1.10; hydrogenated whale oil, 0.83; and margarine, 1.25) (*Res. & Ind.*, August 1959, p. 210).

Tamarind polyose as emulsifying agent: Studies on the preparation of emulsions of cod-liver oil, liquid paraffin, arachis oil, benzyl benzoate and turpentine for pharmaceutical uses, carried out at the L. M. College of Pharmacy, Ahmedabad, have indicated that tamarind polyose has good emulsifying properties and can be used for the preparation of emulsions for oral use. The emulsifying property has been found to be best in the case of cod-liver oil, liquid paraffin and arachis oil. Emulsions prepared with tamarind polyose have better stability than emulsions prepared with aracha, tragacanth and starch.

Tamarind polyose, extracted from tamarind seeds, is dissolved in boiling water and cooled to room temperature. To this solution, the oil is gradually added and the suspension triturated till emulsification (with 50 per cent oil) is complete. It is then passed through a hand homogenizer with jet orifice six times. Ethyl p-hydroxy benzoate (0.15 per cent) may be added to the emulsion as a preservative (*Res. & Ind.*, September 1959, p. 236).

Seaweed for food: Marine algae have been used as human food in several countries for many centuries and the edible species are termed 'laver' in the trade. They

are used in a variety of ways such as in the preparation of jellies, as a thickening agent for textiles, as a vegetable glue and a substitute for gelatin. It is also employed as a cattle food. A process has been developed in Germany for the extraction of a type of edible fat from seaweed and it is claimed to resemble olive oil. In the Orient, certain algae, like the red phorphyras, are highly esteemed as foods and are used in making blancmange and other puddings, in soups, and as condiments. 'Komba' a product made from a particular type of seaweed is one of the standard foods of Japan. Phorphyras are cultivated and widely used in Japan.

In South Wales, there is a fairly well established laverbread industry handling about 4,250 cwt. of laverweed annually. For processing, the seaweed is thoroughly washed to remove all sand and foreign matter. It is then boiled for 12 hours in 6 cwt. capacity boilers; salt and water are added during the boiling to the extent of about 3 lb. of salt and 20 lb. of water per cwt. of seaweed. When the product is considered to be sufficiently cooked, it is removed from the boiler, allowed to cool for about 12 hours, minced and colouring matter added to bring to a standard colour. The final laverbread having a flavour of the sea, is prepared for eating by warming it in fat, and is sometimes first made up into small cakes coated with oatmeal. It is then taken in place of eggs, etc., for a breakfast dish. It is a good source of iodine, iron and other trace metals and is also a mild laxative (Abstracted from *Food Manuf.*, November 1959, p. 443).

New dehydration method for fruit and vegetables: A new method of dehydrating fruits and vegetables is revolutionising one of the oldest food processing techniques for growers in the United States. Developed by the Western Regional Research Laboratory of the U.S. Department of Agriculture, Albany, Calif., it makes use of

a stainless steel mesh conveyor belt as a continuous moving trough for fresh produce. This makes it possible to force hot air up through the wire mesh of the belt to accelerate dehydration.

The classic method of dehydrating fruits and vegetables involves the use of wooden trays and warm sunlight. Besides being slow, this makes it possible for produce to be contaminated with wood slivers and other foreign matter.

Because standard conveyor facilities could not be used, the Cyclone Fence plant of U.S. Steel Corporation at Oakland, Calif., were able to make the new process practical by designing a special belt.

Primarily, this belt is a woven wire product with chain-drive construction. It virtually eliminates heat losses by allowing free air circulation, yet its mesh is not too coarse to retain the smallest types of fruits and vegetables. Consequently, dehydration can now be accomplished more than four times faster than was previously possible.

Faster dehydration not only saves time and money; it allows foods to retain better colour and flavour in storage. It also does away with the problem of food sticking to wooden trays and greatly reduces the possibility of contamination.

Apples, apricots, carrots, potatoes, and bell peppers are typical fruits and vegetables being dehydrated by means of the new process (*Food Manuf.*, November 1959, p. 444).

Protein determination: The use of boiling tubes instead of flasks for Kjeldahl digestions is described. These are held in a specially designed duralumin block which is heated either electrically or by gas. In the distillation process the ammonia is distilled into 2 per cent boracic acid and titrated directly with a mixture (5:1) of bromocresol green and methyl red as an indicator (*Food Manuf.*, November 1959, p. 445).

Sugar determination: For the hydrolysis of sucrose in fruits containing 60-70 per cent of fructose in

the total sugar the following conditions were suitable: 0.1 per cent hydrochloric acid, 20-30 min. in a boiling water bath; 2.4 per cent hydrochloric acid, 8-16 hr. at 30° F, 4-8 hr. at 40° F, or 45-60 min. at 50° F.

No appreciable decomposition of fructose was observed. The determination of invert sugar was effected by Somogyi's method (*Food Manuf.*, November 1959, p. 445).

Collapsible containers: Collapsible containers made of rubber reinforced with nylon are now being produced by the Dunlop Rubber Co., Ltd., for the conveyance of edible fluids in bulk. The containers which are flat when empty, can be rolled up and strapped to the cab of a lorry, thus leaving it free to carry other goods on its return journey. When full, they assume a stable pillow shape, and can be held in position by means of either a tarpaulin secured by ropes, or a special nylon harness.

The makers say that the use of nylon in the construction of the containers ensures that they are comparatively light in weight, are rot-proof and have a high degree of tensile strength. The fabric is coated on one side with neoprene, a synthetic rubber, and on the other with a variety of natural, sweetened or synthetic rubbers, according to the liquid to be carried.

The standard container is fitted with an adaptor for a hose fitting and this incorporates a non-return valve, through which it is filled and emptied. A small manually-operated release valve allows for the escape of any air introduced during filling. Liquid can be completely removed by siphoning, and when necessary the container can be sterilised with boiling water.

The containers are available for general purposes in standard capacities of 250, 500, 800 and 1,000 gal. but can also be made in a variety of dimensions, according to customers' specifications (*Food Manuf.*, November 1959, p. 447).

Onion peeling machine: An onion peeling machine, claimed to

be the first in the world to do the job successfully, was demonstrated recently at the B.F.M.I.R.A. laboratories at Leatherhead before an audience of interested manufacturers. The machine, which is made by W. Brierley, Collier and Hartley, Ltd., is basically composed of a stainless steel drum with a revolving carborundum-faced base plate at the bottom. The onions are fed in at the top in batches of about 20 lb. and are removed from the machine after between 50 and 90 seconds, according to the hardness of the peel. Water is sprayed on the onions while the machine is in operation to remove the dirt and the peelings. Three deflectors inside the stainless steel drum direct the onions towards the centre of the revolving plate and the onions are removed by a hatch at the front of the machine.

The machine is powered by a 1 h.p. electric motor and the base plate revolves at about 250 r.p.m.

B.C.H. say that the machine is also being used for peeling beetroot. For this purpose the base plate with its 70 grade carborundum surface is replaced with one of 100 grade. An output of about 6 tons of beetroot per day is possible (*Food Manuf.*, November 1959, p. 447).

Powdered foods: A new process which has been used to make powders of good colour and flavour from fruit juices, whole and non-fat milk, coffee, beef and chicken broth, and lemonade has been reported from the U.S. Called 'foam-mat' drying, the new process involves whipping liquid food concentrates into a foam with the assistance of food additives, spreading the foam out on a belt or tray, and drying it in a stream of warm air. Finally, the foam is compressed and crushed into powder form.

The fine structure of the foam created in the process is said to remain stable, despite even compressing the powder into pellets, and the powder may be readily reconstituted with water. Another advantage of the foam-dried powders

is that they hold less moisture at a given relative humidity than do spray dried foods and are therefore less liable to cake than powders dried by other processes.

The additive used to develop a satisfactory foam amounts to about 1% of the dry solids in the liquid food concentrate being whipped, and close control of the density can be provided by careful adjustment of the quantity of additive and the amount of whipping (*Food Manuf.*, November 1959, p. 455).

Protein food for Nigeria: A new protein food for fighting malnutrition is now being produced on a large scale in Nigeria by Glaxo Laboratories (Nigeria), a recently formed subsidiary of Glaxo Laboratories, Ltd. The food itself, which is called *Amama*, was developed at their Middlesex laboratories as a result of four years' research. The product is now being made at a new Glaxo factory at Apapa, the Lagos industrial suburb, and it is being marketed by R.E. Harding and Co., of Lagos, and Standard City Chemists, Ibadan.

The food is in powder form, pink in colour, and consists largely of groundnut flour to which carefully calculated proportions of dried yeast, milk casein, sugar, minerals and vitamins have been added. An 8 oz. pack, enough for 8 days, costs about 1 sh. 6 d.

Nigerian health specialists are hoping that the child death rate from protein malnutrition can be cut substantially once the population becomes aware of the possibilities of the food. An extensional education campaign is being used (*Food Manuf.*, November 1959, p. 455).

New insecticides: Two insecticide developments are on the way from Wisconsin Alumi Research Foundation (Madison); they will likely debut within the next few months.

A sulfonamide-based synergist for DDT is closest to commerciality. Based on a byproduct of DDT manufacture, the compound

and several of its analogs are currently under test. One to 2½ parts of the synergist used with 10 parts of DDT yields a combination capable of killing insects resistant to the pesticide alone, and permits lower-safer-concentrations of DDT to be tried in other cases.

An odourless, water-soluble, relatively safe phosphate insecticide which is now under field test, may be ready for licensing next year. It is said to be competitive in cost to the odorous but low-hazard malathion now popular in many formulations (*Chemical Week*, February 27, 1960, p. 72).

Gas chromatographic studies of fish spoilage: Work is in progress to study the chemical nature of fish spoilage with the possible development of an objective index of fish quality or of a means of retarding fish spoilage. The Bureau's Seatile Fishery Technological Laboratory recently completed the first extensive use of the new technique of gas chromatography to determine volatile acids in fish extracts. They are studying the formation of volatile organic acids during deterioration of fish meat. Acetic and formic acids were the only acids found while the fish were organoleptically acceptable. The sequence of formation of individual acids in fish incubated at 34°F, 40°F and 70°F was essentially the same except that propionic acid increased at a greater rate than other acids in the fish incubated at 70°F. (*Comml. Fish. Rev.*, October 1959, p. 21).

NEW INDIAN STANDARDS

Edible tapioca starch: Tapioca starch is used for edible purposes chiefly in the manufacture of sago (*saboodana*); in making puddings, biscuits, confectionery, custard powder, etc. It is also used for a variety of industrial purposes like sizing of textiles, paper making, manufacture of cosmetics, etc. The Indian Standard Specification for Edible Tapioca Starch (IS: 1319-1958) covers requirements and

the methods of test, and details of sampling, packing, marking, etc., and is one of the series of Indian Standard Specifications on edible tapioca products. Other specifications published so far in this series are: IS: 1317-1958 Edible Tapioca Chips and IS: 1318-1958 Edible Tapioca Flour (*ISI Bull.*, November-December, 1959, p. 272).

Fat in milk and milk products:

The dairy industry, trade and the public analyst in India prefer to use the Gerber method for the rapid and routine determination of fat in milk and milk products, when relatively large number of samples have to be analysed at a time. The use of apparatus standardized and calibrated according to the conditions and materials available in our country and the adoption of uniform methods of determination of fat will enable one to obtain comparable results, within a measurable degree of accuracy. The Indian Standard Specification for Apparatus for the Determination of Fat in Whole Milk Evaporated (Unsweetened) Milk, Separated Milk, Skim Milk, Butter-milk and Cream by the Gerber Method (IS: 1223-1958) has, therefore, been prepared to fulfil this need.

The specification covers the following apparatus required for the determination of percentage of fat in milk and milk products:

(a) butyrometers, 6 per cent, 8 per cent and 10 per cent scales, (for estimating fat in whole milk and evaporated (unsweetened) milk);

(b) butyrometers, 4 per cent scale (for estimating fat in separated milk, skim milk and buttermilk);

(c) butyrometer, 70 per cent scale (for estimating fat in cream),

(d) stoppers for butyrometers;

(e) 11.04-ml pipette for milk;

(f) 10-ml pipette for sulphuric acid;

(g) 1-ml pipette for amly alcohol;

(h) automatic measure for sulphuric acid;

(i) automatic measure for amly alcohol;

(j) centrifuge; and
(k) water bath.

Another Indian Standard in this context, which has already been published, is IS: 1224-1958: Determination of Fat in Whole Milk, Evaporated (unsweetened) Milk, Separated Milk, Skim Milk, Butter-milk and Cream by Gerber Method (*ISI Bull.*, November-December 1959, p. 272).

INDIAN PATENTS

63271: *A device for making confectionery:* Comprising a cylinder and a socket with a flange filled at the outlet of the cylinder.—Patented by Nagarkar (*Res. and Ind.*, October 1959, p. 272).

64457. *A process for the manufacture of malted milk powder:* Mixing concentrated malt extract with milk powder, fat and carbohydrates and drying in vacuum driers.—C.S.I.R., (*Res. and Ind.*, October 1959, p. 273).

65402. *Process for hydrogenating unsaturated fatty acids and their esters:* Carrying out hydrogenation in the vapour phase with a fluidized catalyst and at a pressure substantially less than atmospheric pressure.—Patented by Unilever, Ltd. (*Res. and Ind.*, November 1959, p. 299).

63470. *Acaricidal compositions:* Comprising 2, 4, 4—trichlorodiphenylsulphone together with a diluent or carrier.—Patented by N. V. Philip's Blocilampenfabrieken (*Res. and Ind.*, November 1959, p. 300).

62730. *Process for the production of citric acid by fermentation:* Culturing a strain of *Penicillium adametzi zaleski* var. *kuenranii* in a nutrient medium.—Patented by Kyowa Hakko Kogyo Kalreshiki Kaisha (*Res. and Ind.*, December 1959, p. 325).

64458. *A process for the manufacture of malted milk beverage flavoured with cocoa:* Mixing milk powder with malt extract and flavouring with cocoa, caramel or the like and drying in a vacuum drier or under atmospheric pressure.—

Patented by Council of Scientific and Industrial Research (*Res. and Ind.*, December 1959, p. 326).

65283. *A process for the preparation of palatable yeast hydrolysate powder from distillery sludge:* Consisting of washing, autoclaving, enzymatic hydrolysis, concentration and final drying in vacuo to give rise to a light brown powder.—Patented by Council of Scientific and Industrial Research (*Res. and Ind.*, December 1959, p. 326).

65180. *Additive for enriching foods and feeds and process for the manufacture thereof:* Comprising riboflavin phosphate salt or mixture thereof with edible powder.—Patented by F. Hoffmann-La Roche and Co., Aktiengesellschaft (*Res. and Ind.*, December 1959, p. 326).

64030. *Process for the preparation of alkyl- (aryl) mercapto-methylenemides of o, o-dialkylthio- (dithio)-phosphoryl acetic acids with pesticidal activity:* Reacting mercaptane with N-methylolamide of o, o-dialkylthio- or dithio-phosphoryl acetic acid.—Montecatini Società Generale Per L'Industria Mineraria E Chimica (*Res. and Ind.*, December 1959, p. 326).

FOREIGN PATENTS

822,018. *Crisp foodstuff:* A process is claimed for producing a dry material which can be fried into a crisp foodstuff. The process comprises mixing a dry, mainly starch-containing powder, with such an amount of water as is required to obtain a mixture having a moisture content of 30-40 per cent by weight; this mixture is then extruded under a pressure of at least 6 atmospheres to form a coherent ribbon, which is subse-

quently dried either in separate pieces or cut in lengths to a moisture content of 6-10 per cent, preferably 8-9 per cent. The starch-containing powder can, for example be potato powder.—Patented by Nibbit Products Association, Ltd. (*Food Manuf.*, November 1959, p. 458).

822,062. *Fruit cake mixes:* During the preparation of fruit cake mixes, difficulties have been experienced due to the formation of dough during the preliminary mixing of the fat and flour. This difficulty is overcome in this invention by forming a fruit cake mix containing dried fruit, flour, sugar and other ingredients in which the fat is provided in the form of a coating on the fruit. If desired, all or part of the sugar is included in the fat coating and, in this case, the fat and the sugar are creamed together before their application to the fruit. This application is suitably effected by spraying the creamed fat and sugar in a molten state on to the fruit.—Patented by Alfred Bird and Sons, Ltd. (*Food Manuf.*, November 1959, p. 458).

2,904,440. *Soluble flavour:* Separating a volatile flavour from an essence containing a small amount of flavour and a major proportion of aqueous alcohol, then protecting the said flavour by incorporating it in an edible product is the object of a recent patent. In the process, flavour is extracted with a solvent in which neither water nor alcohol is soluble. Solvent is then separated from the other constituents and mixed with an edible oil. This is followed by evaporating the solvent to give a concentrated solution of pure flavour in the oil. Flavour-oil is then incorporated in molten

sorbitol and the mixture allowed to cool (*Food Engng.*, November 1959, p. 101).

2,892,721. *Synthetic butterfat:* Comprising interesterification product of lard and coconut oil with their fatty acyl radicals distributed among glycerol radicals.—Patented by De Witte Nelson, Swift and Co., Chicago (*Food Engng.*, November 1959, p. 141).

820,382. *Testing eggs:* Relates to an apparatus for use in the candling of eggs, which includes an optical magnifying device located with respect to a conveyor for the eggs and having its dimensions correlated with respect to the speed of the conveyor so that a magnified image of an egg passing the optical device can be properly examined: the object is to facilitate the detection of faulty eggs particularly those having fine or hair cracks and promote a high standard of grading for quality.—Patented by J. Lowrie and Co., Ltd. (*Food Trade Rev.*, November 1959, p. 54).

820,270. *Fat composition:* Relates to a process for the production of a modified glyceride oil of the coconut oil group, which comprises reacting at an elevated temperature the oil with a triglyceride of one or more lower fatty acids having from 6 to 12 carbon atoms in the acid molecule; the product may be used as a salad oil comparable to olive oil and having an increased plastic range, is capable of being incorporated in large amounts in, e.g., margarine and mayonnaise, or can be used as a medicinal oil.—Patented by E. F. Drew and Co., Inc., (*Food Trade Rev.*, November 1959, p. 54).



Information from Foreign Journals

THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

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Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Behaviour of ascorbic acid in Indian gooseberry to heat treatment, by Ratnam, C. and Srinivasan, M., *J. sci., industr. Res.*, 1959, 18 C (7), 132.—The Indian gooseberry, *Phyllanthus emblica*, is a rich source of ascorbic acid. Attempts have been made to prepare a stable concentrate of the vitamin from the pulp by dehydration. It has been found that the loss of the vitamin by sun-drying is much more than that by mechanical drying. Subsequent loss on storage of the dried material was negligible. In an attempt to minimise the vitamin loss during drying, the AA. have found that gooseberry pulp dried under vacuum (27 in. Hg.) at 60-80° C, retained almost all the original ascorbic acid (2000-3500 mg. per 100 g. of dried pulp). The vitamin in the dried pulp was retained to the extent of 85 per cent under normal conditions of storage for 14 months.

Separation of tannins and ascorbic acid has been tried with the press juice of the berry. Use of gelatin or hide powder for separating the tannins made the ascorbic acid in the tannin-free filtrate unstable. Separation on ion-exchange columns was not feasible, as both showed identical distribution.

K.L.R.

Expansion of new and old rice during cooking, by Desikachar, H. S. R. and Subrahmanyam, V., *Cereal Chem.*, 1959, 36 (4), 385.—The increase in length and breadth of rice during cooking was used to measure its swelling quality. Old rice could increase in length much more than new rice, and without disintegration. The terminal portions along the long axis and the ventral segment along the short axis

of the grain exhibited greater expansion than the corresponding central portions and the dorsal segment along the long and short axes, respectively, of the grain. Fragility of the cell walls in new rice was evidenced by their tendency to burst earlier during cooking than did those of old rice. The cell walls in parboiled rice exhibited an intact structure even after cooking for 30 minutes.

Some observations on the protective action of Vitamin B₁₂ against thyrotoxicosis, by Sreenivasamurthy, V., Krishnamurthy, K., Swaminathan, M. and Subrahmanyam, V., *Indian J. Physiol. & Allied Sci.*, 1959, 13 (3), 83.—Studies were carried out to find out the effect of vitamin B₁₂ on nitrogen retention and composition of body and liver of vitamin B₁₂ deficient rats injected with thyroxine. The results showed that in B₁₂ supplemented rats, the nitrogen retention was much higher than in the deficient ones. Data on body composition showed that vitamin B₁₂ supplemented animals and higher levels of body proteins and lower levels of fat, while the deficient animals had higher levels of fat and lower levels of body protein. There was no difference in the moisture, protein and fat contents of the livers of the two groups of animals although liver vitamin B₁₂ content was higher in the supplemented group.

Storage of vegetable oils and fats in containers—a review, by Bhatia, D. S. and Rao, B. Y., *Indian Oilseeds J.*, 1959, 3 (3), 144.—The storage life of oils and fats depends on the type of container, storage temperature and composition of oils and fats, etc. In general, glass

containers are the best of all, but their cost and difficulty in handling prohibit their wide use. In glass containers the deteriorating action due to ultra-violet light can be eliminated by using amber coloured or green coloured glass. Aluminium, tinned iron or stainless steel containers are well suited for almost all types of edible oils and fats. Copper, zinc, plain iron, black sheet metal, or galvanized iron containers adversely affect the storage life of oils. The stability of crude oil is more than the refined oil in any container. Hydrogenated oils have also good stability depending upon their compositions. Paper containers with aluminium foil and parchment are suitable for margarine or fats. Coating of metallic or paper containers with certain plastics and enamels gives useful results. Oils in metal containers should be stored as far as possible at low temperatures. It is well known that antioxidants and metal scavengers, when added to oils and fats, increase their stability. Moreover the effects of such compounds during the storage of oils in various types of containers have not been fully studied.

The equilibrium relative humidity of garlic powder, by Pruthi, J. S., Singh, L. J. and Giridhari Lal, *J. Sci. Fd. Agric.*, 1959, 7, 359.—Based on sorption isotherms or equilibrium relative humidity curves, the packaging characteristics of garlic powder have been determined. It is shown that (1) garlic powder is a highly hygroscopic product, picking up moisture even at 20 per cent R.H.; (2) for a typical garlic powder (moisture 6 per cent), the equilibrium relative humidity at 25° is about 13 per cent

(3) the critical point for garlic powder as regards caking was found to be at 10.6 per cent moisture level, and the danger point at 9.5 per cent.

A rapid spectrophotometric method for the detection and estimation of adulterants in tomato ketchup, by Beerh, O.P. and Siddappa, G. S., *Food Technol.*, 1959, 13 (7), 414.—A rapid method has been evolved for the estimation of lycopene in tomato products based on the measurement of absorption at 503 m μ using the petroleum ether extract of the total carotenoids. The replacement of tomato solids in tomato ketchup by such adulterants as carrot, ash gourd, pumpkin, sweet potato, papaya and apple pulps lowers the lycopene content of the product. On this basis, the tomato solids content of the product has been determined by estimating its lycopene content.

Adulterants like carrot pulp increase considerably the β -carotene content of the ketchup. There is very little loss in the lycopene content of tomato ketchups, genuine as well as adulterated, during a storage period of 2 months at 37° C. A lycopene index of 475 μ g/g. of tomato solids has been tentatively proposed for the estimation of the extent of adulteration in tomato ketchup, when other fruit and vegetable pulps are employed as adulterants.

Studies in the preservation and storage of passion fruit juice (*Passiflora edulis*, Sims.)—II. **Colour and flavour retention**, by Pruthi, J. S., *Indian Food Packer*, 1959, 13 (9), 7.—A detailed study on the effects of various factors like deaeration, methods of preservation, types of containers, storage temperatures on over-all

colour, absorption spectra, flavour and shelf-life of the processed passion fruit juice has been reported. Absorption curves of petroleum ether extracts of fresh and 3 year old samples of passion fruit juice have been presented.

There was maximum darkening at 37° C and minimum at low temperatures. The optical density of alcoholic extracts of juices stored for 12 months at 37° C, 24-30° C, and 5-7° C increased from the initial figures of 0.262-0.278 to 0.582-0.853 0.340-0.564 and 0.110-0.282 respectively.

Comparing the different methods of preservation, freezing preservation proved to be the best. SO₂ checked browning at low temperature, but its bleaching action was off-set at higher temperatures. Darkening was slightly less in canned samples than in the bottled ones, there being no significant difference between plain and A.R. lacquer sets.

The flavour of passion fruit juice is highly susceptible to quick oxidation particularly at high temperatures. Thus, at 37° C, its shelf-life was hardly 2-3 months, while at room temperature (24-30° C) 9-12 months, at 5-7° C about 3 years and at 6.6° C, it could still be kept longer.

An improved method for the determination of uric acid in insect infested foodstuffs, by Venkata Rao, S., Krishnamurthy, K., Swaminathan, M. and Subrahmanyam, V., *Ann. Biochem. exptl. Med.*, 1959, 19 (8), 187.—An improved method for the determination of uric acid in insect-infested foodstuffs has been described. The uric acid present in aqueous extracts of foodstuffs has been selectively destroyed by the enzyme uricase

and the 'true' uric acid content calculated by subtracting the values for the residual uric acid-like substances from the total uric acid values. The results obtained by the method have been found to be in close agreement with those obtained by a paper chromatographic procedure. The method has been used for the assay of uric acid in certain infested cereals and pulses, and found to give satisfactory results.

A method for the detection and estimation of citicide, by Krishnamurthy, K., Srinivasan, K. S., Mujumder, S. K., *J. sci. industr. Res.*, 1959, 18 B (8), 333.—A method based on the colour reaction of Citicide (a product obtained by chlorinating turpentine) with pyridine and aqueous potassium hydroxide, has been developed for its detection and estimation. The specific orange colour developed by the reagents with Citicide differentiates it from Toxaphene and Chlordane. Citicide in concentrations as low as 30 λ can be estimated by this method.

Inhibition of oxidation of ascorbic acid by EDTA, by Rao, M. V. L., Sastry, L. V. L., Srinivasan, M. and Subrahmanyam, V., *Sci. Fd. Agric.*, 1959, 8, 436.—Addition of small amounts of EDTA to acidified solutions of ascorbic acid, completely protects the vitamin against copper-catalysed aerobic oxidation for over 6 days at room temperature. In the absence of acid, excess EDTA acts as a pro-oxidant for the vitamin. Under optimal conditions, solutions of ascorbic acid containing EDTA could be heated on the water-bath to complete evaporation without any loss of the vitamin.

PART II (Indian)

ANALYTICAL

Application of Baudouin test to the analysis of honey—A new test for the detection of HMF, by Mitra, S. N., Mathew, T. V. and

Mallick, A. K., *J. and Proc. Inst. Chem.*, 1959, 31 (4), 175.—Hydroxy methylfurfural (HMF) is found in honey adulterated with technical or commercial invert sugar. The

HMF content of genuine honey may also increase on storage even at ordinary temperature. Heating honey to unfavourable temperature also produces similar results. The

presence of HMF is detected by the 'resorcin-hydrochloric acid' test called Fiehe's test. In the present study, the authors have applied the principles of Baudouin test for the same. The test consists in macerating 5 g. of honey with three successive 10 ml. portions of ether, filtering it and evaporating the clear ether extract at room temperature. About 0.5 ml. of alcohol is then added to the residue followed by the addition of 3 ml. of concentrated HCl. To the acid solution are added about 3 ml of fresh, pure sesame oil and the contents shaken thoroughly for 30 seconds. The lower acid layer is found to acquire a brilliant red colour in presence of HMF. The points to be noted in border line cases have been mentioned. Analysis of a large number of samples of honey shows that the new test tallies well with the resorcin-hydrochloric acid test.

BIOCHEMISTRY AND NUTRITION

Alloxan resistance of albino rats, by Mukherjee, S. K. and De, U. N., *J. sci. industr. Res.*, 1959, 18 C (10), 198. The causes for the occasional resistance to the diabetogenic effect of alloxan in experimental diabetes of albino rats have been investigated. Studies made on rats receiving repeated diabetogenic dose of alloxan from the beginning and on rats which had received several sub-diabetogenic doses (for 4 days) followed by repeated diabetogenic dose of alloxan have shown that failure of an effective diabetogenic dose or sub-diabetogenic doses of alloxan may produce tolerance in rats to alloxan, which can be overcome on increasing the number of injections of alloxan in animals made to fast for a prolonged period. It has been also noticed that high blood glutathione level and generalized liver damage are two significant features associated with alloxan resistance in rats. Though in resistant animals the β -cells of the islands of Langerhans are damaged

like those in diabetic animals, no loss of body weight, hyperglycemia or persistent glycosuria is observed. Absence of hyperglycemia in spite of β -cell damage has been correlated to generalized liver damage, and it is suggested that increase in the blood glutathione level may be responsible for the phenomenon of alloxan resistance.

Trypsin inhibitor from green gram (*Phaseolus aureus* R.), by Hanavar, P. M. and Sohoni, K., *J. sci. industr. Res.*, 1959, 18 C (10), 202. The trypsin inhibitor from green gram obtained by ammonium sulphate fractionation (0.4 per cent saturation) has been purified and its properties have been studied. The inhibitor gives an ultraviolet absorption spectrum typical of a protein. Its elementary composition, and its tyrosine, tryptophane and cystine contents have been estimated; tryptophane content is low. The molecular weight of the inhibitor is 18,000. The inhibitor inhibits trypsin and acetyl trypsin strongly; 1.0 μ g. of the inhibitor inactivates 1.0 μ g. of trypsin, the inhibition being non-competitive. Digestion of benzoyl-L-arginine ethyl ester by trypsin is also inhibited by the inhibitor. Pepsin and chymotrypsin are not inhibited. The inhibitor is stable during storage and when heated in acid solution.

Role of oxalic acid in higher plants, by Srivastava, S. K. and Krishnan, P. S., *J. sci. industr. Res.*, 1959, 18 A (11), 220. Oxalic acid is a normal major constituent of the green leaves of spinach (*Beta bengalensis*), colocasia (*Colocasia antiquorum*; *Colocasia violacea*), alopecia (*Alocasia decipiens*; *Alocasia macrorrhiza* Schott), amaranthus (*Amaranthus gangeticus*), beet (*Beta vulgaris*) grown in the open. Eticolated spinach plants, however, contain very little of oxalate. *Alocasia* plants grown in the dark are characterized by low content of oxalate in the leaf blades, but high content in the leaf stalks. Colocasia tubers show an increase

in the oxalate content during sprouting. Once formed, oxalate seems to be utilized by the plant with difficulty. Storage of tubers of colocasia for four months does not result in any considerable alteration in their oxalate content. Green spinach plants transferred to the dark do not show any significant diminution in oxalate. The results with detached leaves, stored in the dark, are inconclusive: in some experiments no change could be observed in the oxalate but in others a significant diminution could be observed followed by a rise. Incubation of homogenates of leaves does not result in a change in the oxalate content. The oxalate in the leaves of alopecia does not show a diurnal periodicity. It would appear that oxalic acid, though a normal constituent of green leaves, is an end product and does not enter into active metabolism of the plant. However, the natural drying of the leaves of alopecia is attended by the disappearance of considerable amount of oxalates.

Studies on the nutritive value of enzymatic protein digests. Part III: Influence of enzyme and degree of hydrolysis on the nutritive value, by Esh, G.C. and Som, J.M., *Ann. Biochem. exptl. Med.*, 1959, 19(10), 241.—Beef was hydrolysed with papain to obtain digests at various stages of hydrolysis by altering the concentration of the enzyme and period of digestion. The enzymic digests were further digested with acid to raise the degree of hydrolysis. When fed to protein-depleted rats as the only source of amino-acids and peptides, highest protein efficiency ratio was observed for the digest at 46-48 per cent of hydrolysis. Considerable difference in the nutritive values of meat digests, produced with different proteolytic enzymes, was observed. Peptic digestion gave the best result. The possibility of early absorption from the duodenum of some amino-acid peptide complexes at some stages of protein hydrolysis has been indicated.

Nutritive value of pure strains of Indian pulses, by Dhingra, P.K. and Das, N.B., *Ann. Biochem. exptal. Med.*, 1959, 19(10), 245.—Pulses are good sources of protein and are widely used in Indian dietary. The quality of protein depends on varietal changes. In this study, the authors have analysed two pure strains of each of the six pulses, viz., Bengal gram, black gram, green gram, red gram, lentil and pea for their chemical composition. Values for total protein, ether extractives, fibre, ash, insoluble matter, soluble minerals, calcium, total phosphorus, total iron and soluble carbohydrate have been reported on dry weight basis. It is found that the total protein content of the different pulses varies from 20.11 to 32.37 per cent. Phytin phosphorus varies from 22.63 to 50.23 of the total phosphorus content. Wide variation is observed in relation to strain of the pulses. Protein efficiency ratio P.E.R. of the pulses has been determined by feeding weanling rats at 10 per cent level of pulse protein for a period of 4 weeks. Significant strain variation with respect to P.E.R. was observed in the case of green gram, lentil and pea. Among the pulses studied, Bengal gram (strain NP 53) has the highest P.E.R. The P.E.R. of the pulses was, however, lower than that of casein, probably due to the deficiency or inadequacy of certain essential amino acids.

K.L.R.

Studies on the effective minimum dose of hydrolysed glucose cyclo-acetoacetate for the prevention of saturated fat and cholesterol induced lipaemia, by Saikia, A., Brahman-kar, D. M. and Nath, M. C., *Ann. Biochem. exptal. Med.*, 1959, 19(11), 275.—The effect of hydrolysed glucose cyclo-acetoacetate (GCA) at different dosages on plasma and tissue levels, of cholesterol, lipid and lipid phosphorus in saturated fat plus cholesterol induced lipaemia has been studied. Dosages of 60-80

mg. per 100 g. per body-weight of hydrolysed GCA have been found to maintain these factors near the normal level and to help proper growth of the animals. The minimum effective dose of GCA (hydrolysed) to check the rise of liver fat has been found to be 80 mg./100 g./body-weight.

Studies on the metabolic role of medicinal (Ayurvedic) calcium preparations: Effect on calcification, by Motlag, D.B. and Nath, M.C., *Ann Biochem. exptal. Med.*, 1959, 19 (11), 279. The effect of calcium preparations from pearls, corals and conch shells, calcium carbonate and calcium lactate on calcification of bones and teeth in infant rats has been studied. The degree of calcification as judged from the ash content as also from calcium and phosphorus contents, has been found to be about the same with all the studies. No appreciable difference could be observed between soluble and insoluble sources of calcium in their effect on calcification. The significance of the factors studied, i.e., ash content, calcium and phosphorus content and the Ca:P ratio in relation to calcification has been discussed.

DAIRY

The amino-acid content of goat's milk at different stages of lactation, by Barnabas, T. and Mawal, R.B., *Indian J. Dairy Sci.*, 1959, 12 (2), 63.—The changes in the amino acid composition of the milk of a goat (*khilari* breed) during the progress of lactation upto 61 days after parturition have been studied using paper chromatographic and microbiological assay procedures. There was a progressive decrease in the values for total solids, fat percentage and total nitrogen of goat's milk with advance in lactation. The values for tryptophan, isoleucine, valine and arginine in goat's mature milk were similar to those reported in the case of cow's milk while lysine content of the farmer was slightly

higher and the values for leucine, phenyl-alanine and threonine were lower. The values for glutamic acid, glycine and serine contents in goat's milk remained constant throughout the lactation period. The other amino-acids gave maximum values on the first few days after parturition and thereafter the values generally decreased with advance in lactation.

Study of the chemical changes occurring in domiati cheese during pickling, by Sharara, H.A. *Indian J. Dairy Sci.*, 1959, 12 (2), 77.—The changes occurring in the different components of domiati cheese when cured in pickling salted whey for intervals of 4 months were investigated. Increasing the time of cheese pickling resulted in a decrease of the moisture content of cheese. Cow milk cheese was generally higher in acidity than buffalo milk at the same time of pickling. The percentage of fat increased in cheese with storage and it was generally higher in buffalo milk cheese than in cow milk cheese. Cow milk cheese, in general, contained more total nitrogen and the values decreased as the ripening period was prolonged. Cow milk cheese showed a greater soluble nitrogen content than buffalo milk product. Both kinds of cheeses had their maximum soluble nitrogen content and ratio of soluble nitrogen to total nitrogen at the end of the pickling period. Cow's cheese was always higher in percentage of N.P.N. than buffaloes' cheese unlike the ammoniacal nitrogen calculated on the basis of total nitrogen. The percentage of N.P.N. increased gradually throughout ripening in both kinds of cheeses. Buffalo milk cheese contained less chlorine than cows' cheese and the chlorine content decreased as the ripening time increased. The percentages of both Ca and P were higher in buffalo milk cheese than in cow milk cheese and the values increased gradually throughout pickling.

Changes in butter constants on storage, by Roy, S.C. and Sen, A.R., *J. and Proc. Inst. Chem.*, 1959, 31(4), 153.—Butterfat on long storage, deteriorates and its constants such as Reichert value, B.R. reading, acidity, etc., are affected. There have been, however, conflicting reports on the nature and extent of change in the constants. In this paper, the authors have studied systematically the deterioration taking place in the stored butter to find out whether the change in the constants is gradual or otherwise. Samples of butter, salted and unsalted, were stored in different types of containers at room temperature (20°-30°C) and in refrigerator (10°C). One lot of butter was stored with and without formalin added as a preservative. Aliquots of butter were taken out at monthly intervals and analysed for B.R. reading at 40°C, Reichert value, acidity (free fatty acids as oleic acid per cent) and Kreis test. The results obtained have been presented and discussed. The changes taking place in the butter constants were found to be irregular and arbitrary. In general, it was found that within two to three months, the butter samples became very soft, had no texture and developed an off-flavour. In some cases fungal growth was also observed. The changes observed in the case of butter were not apparent in the case of *ghee*.

K.L.R.

FISH

Preservation of prawns in ice and the assessment of their quality by objective standards, by Velankar, N.K. and Govindan, T.K., *Indian J. Fish.*, 1959, 6(2), 306.—Observations were made on the trimethylamine, total volatile nitrogen, acid-soluble orthophosphate and free amino acid nitrogen contents and bacterial counts of Indian prawns (*Penaeus indicus*, *Metapenaeus affinis*, *M. dobsoni*) preserved in ice. The prawns were found to have a keeping quality of about 10-51

days before spoilage set in. The period of prime quality as seen from the objective tests employed did not exceed one week. Heading the prawns prior to icing minimised the incidence of black discolouration (melanosis) peculiar to prawns and appears to be an essential step if the desired storage duration is more than 1 or 2 days. Trimethylamine and total volatile nitrogen changes are not significant during the first 10 or even 15 days, and are useful for indicating distinct spoilage. Phosphate and more particularly the free amino nitrogen content reflected the number of days elapsed in ice storage and might be used in assessing the changes in iced prawns before the onset of spoilage. The decrease in the amino nitrogen is due to loss of free amino acids through leaching and since free amino acids are present in crustacean muscle in considerable quantity compared with fish muscle, their loss through leaching may be a contributing factor in lessening the flavour of prawns kept in ice for extended storage periods. The bacterial flora of the iced prawns consisted mainly of gram-negative achromic rods and coccobacilli, and to a lesser extent, of orange and yellow pigmented rods and micrococci.

Changes in chemical composition of fish tissue during storage by Bose, A.N., and Roy Chowdhury D., *J. and Proc. Inst. Chem.*, 1959, 31(4), 171.—Fish is one of the foodstuffs easily susceptible to spoilage. Organoleptic tests generally adopted to assess the degree of freshness of fish have limitations. Objective tests have been employed by many workers, which depend on the estimation of total volatile nitrogen, trimethylamine, ammonia, etc. A method of electrometric titration has been developed by Stransby and Lemon for determining the relative freshness of haddock. Most of the earlier work on these tests was done with sea-fish. The authors have presented in this paper data collected

on fresh water fish. The total volatile nitrogen, trimethylamine nitrogen and ammonia nitrogen values for the tissue of fresh water fish, *Rohu* (Lebeo Rohita) kept at 80-90° F have been compared with the organoleptic rating. The values overlap at different stages of spoilage and are not therefore useful in indicating the state of spoilage. It is found that the B-value of Stansby and Lemon bears a close relationship with organoleptic score and as such can be used as objective measure of spoilage. In the case of fish stored in plain ice or ice containing 0.5 per cent sodium benzoate as preservative the B-values are found to decrease in the later stages of spoilage, which may be due to the formation of free acids. The rate of spoilage and changes in the chemical composition during spoilage of fish is found to be largely influenced by the source of fresh water fish, as revealed by the analysis of fish from clean ponds and commercial *bherie*.

K.L.R.

FRUIT AND VEGETABLE PRODUCTS

Pharmacological investigation of the fruit of *Embllica officinalis* Gaertn., by Jamwol, K.S., Sharma, I.P. and Chopra, C.L., *J. sci. industr. Res.*, 1959, 18C (9), 180.—*Embllica officinalis* Gaertn., popularly known as the Indian gooseberry, is widely used in indigenous medicine for several disorders. It is one of the richest sources of vitamin C. The pharmacological investigation of the fruit has not been carried out so far to assess its therapeutic value. In this note, the authors have reported results of a preliminary study on the pharmacology of phyllemblic acid isolated from the dry powdered pericarp of the fruit. The fruit contains several other ingredients besides phyllemblic acid. Rabbits tolerated doses of 150 mg./kg. of the acid administered intravenously or orally. Doses up to 100 mg/kg. did not

produce any effect on the blood pressure and respiration of anaesthetized dogs. It also had no effect on the isolated intestine of rabbits and uterus of guinea-pigs and rats. In vitro studies on the antibacterial activity of solutions containing different concentrations of phyllemblic acid showed that the acid had no inhibitory action against *Sal. typhora*, *Sal. paratyphi*, *Sal. schottmulleri*, *Sh. dysenteriae shigae*, *Sh. dysenteriae* Flexner, *V. cholerae* Inaba, *Escho. coli*, Proteins K 19, *M. pyogenes* var., *aurens*, and *Strep. pyogenes* in concentrations up to 1 mg./ml.

K.L.R.

Studies on the microbial spoilage of canned food. II. Effect of heat, H-ion concentration and chemicals on the spoilage bacteria, by Rangaswami, G. and Venkatesan, R., *Proc. Indian Aca. Sci.*, 1960, 51(1), 9.—Seven bacterial species, viz., *Bacillus circulans* Jordan, *B. brevis* Migula, *B. subtilis* Cohn, *B. coagulans* Hammer, *B. licheniformis* (Weighman) Chester, *Clostridium histolyticum* (Weinberg and Seguin) Bergey et al. and *Lactobacillus fermenti* Beijerinck, isolated earlier from spoiled canned foods, were studied for their physiological properties in relation to heat treatment, H-ion concentration of substratum and susceptibility to chemical preservatives. The species of *Bacillus* were highly resistant to heat treatment, *Cl. histolyticum* was less resistant and *L. fermenti* was labile to heat. The rate of death of the bacterial population in *B. licheniformis*, *B. circulans* and *B. coagulans*, followed three distinct phases: firstly a major population was destroyed in a relatively short period followed by a rapid logarithmic destruction and finally a decreasing rate of death. In *B. brevis*, *B. subtilis*, *Cl. histolyticum* and *L. fermenti* the population was destroyed in an almost uniform pattern. All the seven bacterial species were found to thrive well in a wide range of pH and *L.*

fermenti was capable of multiplying even at pH 3.0 indicating that it can spoil highly acidic food products. *L. fermenti* and *Cl. histolyticum* were highly sensitive to salt concentration of the medium, whereas *B. licheniformis* was found to be a facultative halophile as it could grow even in 13 per cent salt concentration. In general all the bacteria were inhibited at a sugar concentration of 40-45° B, but *Cl. histolyticum* was relatively less tolerant as it failed to grow even at 30° B. Na-benzoate and potassium metabisulphite, when tested on the bacteria, were found to have a synergistic effect when combined together than when tested alone. They were more effective in acid and alkaline ranges of the substratum than in neutral range. Also, when the combination of the chemicals was tested at various sugar concentrations of the medium, only half the concentration of the sugar could suffice to inhibit the bacteria. On the basis of the results it is suggested that *L. fermenti* could be easily eliminated by heat treatment or addition of salt to the product, *Cl. histolyticum* by heat or addition of salt or sugar and the species of *Bacillus* by a combination of Na-benzoate and potassium metabisulphite in a sugar medium acidified with edible acids.

OILSEEDS

Compositional studies of Indian groundnuts: Part II South Indian groundnuts, by Thirumala Rao, S. D. and Murti, K. S., *Indian Oilseeds J.*, 1960, 4(1), 4.—One hundred and ten representative samples of groundnut of different varieties (31 Peanut, 36 Coromandels, 2 Pollachi Red and 40 TMVs samples) obtained from the successive harvesting seasons of 1954 to 1958 have been analysed.

Proximate composition of eight varieties of groundnut grown in Andhra and Madras has been determined. From the iodine values

of the oils, groundnuts fall into two different groups—those having oil of lower unsaturation and the others having oils of greater unsaturation. It is suggested that the relative times and consumption of hydrogen taken by these oils from these two varieties to vanaspati consistency be studied to see if there are any significant differences in these.

The shell content of Pollachi Red variety is lowest (18) while those of TMV-2, Peanuts and Coromandels are higher in the increasing order; TMV-1, TMV-3 and TMV-5 varieties are the highest.

The average oil content of the 110 samples presented in this paper is 50.4 per cent on 5.0 per cent moisture basis, which is almost the same as that (50.3 per cent) of 177 samples reported in the earlier paper. The average values of Peanuts among local varieties and TMV-3 and TMV-4 among the improved departmental strains are higher than this figure. However, as only two samples of TMV-4 are analysed it is not safe to draw any definite conclusion regarding the relative contents of this variety. In the earlier work, it was found that the average oil content of 19 samples of TMV-3 (48.8 per cent), as also the combined average value of TMV-1, TMV-2 and TMV-3 varieties (49.5 per cent), was found to be definitely less than those of either Peanut or Coromandel variety seeds.

The desirability of studying the decorticating performance of the different varieties, in view of the qualitative and quantitative differences in shells of these is suggested.

The quality of Andhra and Madras groundnuts compares favourably with that of groundnuts grown in other countries. Further work on Indian groundnuts from other States is in progress.

OILS AND FATS

Investigation of less-known oils in hydrogenation industries

use of tobacco seed oil, by Chakrabarty, M. K. and Chakrabarty, M. M., *J. sci. industr. Res.*, 1959, **18A** (11), 530.—Hydrogenation of tobacco seed oil has been investigated with a view to finding out its suitability as a new source material for vanaspati industry. For refining of the raw oil, before subjecting it to hydrogenation, treatment of the oil with 16° Be alkali in 0.25 per cent excess and 2 per cent Fulmont earth plus 0.5 per cent activated carbon gives the best results.

It has been observed that on hydrogenation, besides saturated fatty acids, iso-oleic acid also contributes to the melting characteristics of the fat. Iso-oleic acids are undesirable constituents and do not offer any improvement in the stability of the product and restrict the formation of the saturated fatty acids. The variation in the characteristics and chemical composition of the hydrogenated products obtained under different conditions of hydrogenation have also been investigated.

Recent advances in the processing and utilization of oils, fats and allied products, by Anon., *Res. and Ind.*, 1959, 4(12), 301.—Some of the recent developments in the processing and utilization of oils, fats and allied products relate to the refining of cottonseed oil using sodium silicate; refining of tobacco seed oil by a continuous degumming and alkali refining process; potential uses of rice bran, *neem*, tobacco seed and safflower oils; preparation of cation-active material from indigenous fatty oils for wetting, emulsifying and detergency operations in the leather, textile and allied industries; preparation of alkyl resins, and srifirdiols (polymeric fatty acids) and their applications; use of cashewnut shell liquid in insecticidal compositions; detection of synthetic essence of mustard in mustard oil; upgrading of inferior quality cashewnut shell liquid, etc. The salient features of these developments as presented at the recent symposium held at Kanpur are brought out in this article.

VITAMINS

Stabilization of vitamins in pharmaceutical preparations: Part I—Influence of common vehicles on the stability of vitamins A, B₁ and C, by Upreti, M. C. and Mohan Rao, V. K., *J. sci. industr. Res.*, 1959, **18C** (11), 229.—The stabilities afforded by different combinations of bases like sugar syrup, propylene glycol, glycerol, sorbitol, etc., to vitamins A, B₁, and C at 37° C have been studied. Sorbitol-propylene glycol-glycerol-ethyl alcohol (2:1:1:1), syrup-glycerol-water (2:2:1) and syrup-glycerol (1:1) combinations retain 70 per cent of vitamin A, 73 per cent of vitamin B₁ and 51 per cent of vitamin C respectively during five months of storage. Vitamin C keeps well in the presence of vitamins A and B₁ in syrup-water (85:15) and syrup-propylene glycol (1:1). Syrup-glycerol-water (2:2:1) gives the best stability to a preparation containing vitamins A, B₁ and C. In general, sugar syrup affords considerable stability to all the three vitamins in different combinations with other vehicles.

PART III (Foreign)

ANALYTICAL

Determination of moisture content in cereals. I.—Interaction of type of cereal and oven method, by Oxley, T. A., Pixton, S. W. and Howe, R. W., *J. Sci. Fd. Agric.*, 1960, **11** (1), 18.—This paper gives the moisture content values obtained by five different oven-drying methods, in common use, for a number of non-oily cereal grains at different moisture levels. It is shown that the values obtained for the moisture content of a grain sample given by various methods are different and that the amount of difference between the methods is influenced by the type of grain being investigated. The difference is less for high-protein hard wheats, parboiled rice and flint maize than it is for the soft wheats, milled rice, dent maize, oats or barley.

Hence it is concluded that, when more than one type of grain is to be dealt with, no two methods of the oven type will give the same results for all grains and, it is not valid, therefore, to have alternative standard methods, or a standard method and sub-standard, except for one precisely specified kind of grain.

Detection and estimation of fungal amylases in flour, by Knight, R. A., *J. Sci. Fd. Agric.*, 1960, **11** (1), 54.—As the methods normally used in the examination of flour do not reveal the presence of fungal amylases, a technique has been developed which may be employed for their detection and semi-quantitative estimation. This is based on the decrease in α -amylase activity which occurs when a flour extract containing calcium ions is heated at 68° for 30 min.

Confirmation of the presence of fungal amylase and of the amount which has been added to flour can be obtained by using the relationship between cereal α -amylase activity and Hagberg number.

Determination of volatile components of foodstuffs. Techniques and their application to studies of irradiated beef, by Merritt, C. Jr. *et al.*, *J. agric. Fd. Chem.*, 1959, **7** (11), 784.—Techniques have been developed for the isolation, separation, and identification of volatile components of various foodstuffs such as meat, fish, vegetables and coffee. Isolation and separation are accomplished by low-temperature, high-vacuum distillation techniques and by gas chromatography. Three main fractions are usually obtained by the low-temperature, high-vacuum

technique: a carbon dioxide fraction, a center cut, and a water fraction. Further separation is required before final identification of the components by mass spectrometry can be made. The efficiency and advantages of the different separation techniques are discussed. Some results of studies of the volatile components isolated from samples of irradiated beef are given.

BIOCHEMISTRY AND NUTRITION

Studies on protein concentrates for animal feeding, by Bunyan, J. and Price, S. A., *J. Sci. Fd. Agric.*, 1960, 11 (1), 25.—The protein quality of a wide range of common protein foods has been investigated by means of chemical, biological and microbiological tests. B vitamin contents have also been determined in some materials. Results for a large range of meat meals, whalemeat meals, fish meals and miscellaneous samples are presented and discussed in separate sections, and attention drawn to the existence of certain correlations.

Comparative vitamin B₁₂ assay of foods of animal origin by *Lactobacillus leichmannii* and *Ochromonas malhamensis*, by Lichtenstein, H., Beloian, A. and Reynolds, H., *J. agric. Fd. Chem.*, 1959, 7 (11), 771.—Few directly comparative data on the vitamin B₁₂ content of foods, as assayed by the *Lactobacillus leichmannii* and *Ochromonas malhamensis* methods, are available as a basis for judging the relative validity of the two methods. This report presents the results of parallel assays using the two methods on a series of foods of animal origin. While results of the assays were generally of the same order of magnitude in 15 of the 27 samples tested, the vitamin B₁₂ activity as measured by the *O. malhamensis* method was significantly higher at the 5 per cent level than when measured by the *L. leichmannii* method. These results, unexpected in view of the reported greater specificity for vitamin B₁₂

of *O. malhamensis* as compared to *L. leichmannii*, may be due to the presence in certain foods of animal origin of substances other than vitamin B₁₂ which stimulate the growth of *O. malhamensis*.

Study of the effect of ripe papaya extract on the proteolytic activity of papain, by Bahadur, K. and Atreya, B. D., *Enzymologia*, 1960, 21 (5), 325.—The amount of papain present in the latex of *Carica papaya* is found to be maximum just before ripening of the fruit. Thereafter, the enzyme activity decreases as ripening advances. In this paper, the influence of ripe papaya juice on the proteolytic activity of papain obtained from raw papaya has been studied using water soluble proteins of gram flour (flour from the seeds of *Cicer arietinum*) as substrate. Three sets of experiments have been carried out using 2, 5 and 15 ml. of ripe papaya extract and the reaction mixture is maintained at different pH ranging from 6.2 to 7.8. Proteolytic activity has been determined at regular intervals of 0, 24, 48, 72, 96 and 120 hours. The results have been graphically represented and discussed. It is found that the ripe papaya extract acts as an inhibitor of the proteolytic activity of the enzyme present in raw papaya. The inhibitory effect is more pronounced with smaller volumes of concentrated extract from the ripe fruit. The results indicate that certain inhibitors are formed in papaya during ripening, which deactivate the papain initially formed in the fruits.

K.L.R.

All vegetable protein mixtures for human feeding. I. Use of rats and baby chicks for evaluating corn-based vegetable mixtures, by Squibb, R. L., *et al.*, *J. Nutr.*, 1959, 69 (4), 351.—Corn-based, simplified all-vegetable protein mixtures containing corn, sesame, cottonseed, torula yeast and green leaf meal were evaluated by amino acid analysis and by growth and feed efficiency studies using

both rats and baby chicks. The data indicated that a combination designated as INCAP Vegetable Mixture 8, composed in per cent of: lime-treated corn, 50; sesame flour, 35; cottonseed flour, 9; kikuyu leaf meal, 3; and torula yeast, 3, was palatable and gave good growth and efficiency of feed utilization in rat trials. Neither the addition of 0.45 per cent of free lysine nor the substitution of skim milk for part of the corn improved the growth or feed efficiency of rats fed the mixture, although addition of lysine did improve growth and feed utilization of the mixture by chicks. When the mixture was diluted with corn-starch to feed rats at a 15 per cent protein level, added lysine improved growth and feed efficiency. On the basis of the studies, INCAP Vegetable Mixture 8 was recommended for clinical feeding trials in children.

All vegetable protein mixtures for human feeding. II. The nutritive value of corn, sorghum rice and buckwheat substituted for lime-treated corn in incap vegetable mixture eight, by Bressani, R., *et al.*, *J. Nutr.*, 1959, 69 (4), 351.—Baby New Hampshire chicks were used to measure the nutritive value of ground yellow corn, grain sorghum, rice, and whole buckwheat substituted for masa flour (from lime-treated corn) in INCAP Vegetable Mixture 8, a formula designed for the supplementary and mixed feeding of infants and young children and containing corn masa flour, sesame flour, cottonseed flour, torula yeast and kikuyu leaf meal. In two experiments, buckwheat produced significantly better growth and feed conversion than any of the cereal grains. Yellow corn gave the next best growth response, followed by rice and sorghum. Substitution of each of the cereal grains resulted in better growth than with masa flour, though the masa flour produced better feed conversions in most cases. In a third experiment in which all rations were supple-

tion having an 18-fold increase in specific activity, based on nitrogen content, was obtained. An over-all assay procedure for screening fractions was developed, employing hemoglobin in 3M urea as a substrate. The assay reaction was carried out at pH 4.4. at 37° C for 4 hours, and the extent of proteolytic action was determined from the amount of tyrosine produced in the protein-free supernatant.

FISH

Chemical studies on the herring (*Clupea harengus*). III.—The lower fatty acids, by Hughes, R. B., *J. Sci. Fd. Agric.*, 1960, 11 (1), 54.—The application of gas chromatography and paper chromatography to a study of the lower volatile fatty acids of herring is reported. Fresh herring flesh contained acetic acid with smaller quantities of formic acid and propionic acid, and occasionally a trace of n-butyric acid. The quantities of all these acids increased in the spoiling fish, while isovaleric acid became apparent at the later stages. The presence of antibiotics did not affect the rate of production of the acids in fish held in ice. Heat processing at 115.5° in sealed cans did not alter the content of individual acids in the fish.

FRUIT AND VEGETABLE PRODUCTS

The free amino-acids of certain British fruits, by Burroughs, L. F., *J. Sci. Fd. Agric.*, 1960, 11 (1), 14.—The total and alcohol-soluble nitrogen contents have been determined and the free amino acids examined in strawberry, gooseberry (green and ripe), blackcurrant, redcurrant, loganberry, raspberry, blackberry and tomato. Most of the common amino-acids were present, alanine and glutamine being the two most generally prominent. Free amino-acids have been examined in 20 non-edible species of apple and pear, in medlar (unripe and ripe) and in three species of *Vaccinium*. I-aminocy-

clopropane-I-carboxylic acid was not found in any fruit except ripe cowberries.

Selective media for yeast and bacteria in apple juice and cider by Beech, F. W. and Carr, J. G., *Food Technol.*, 1960, 11 (1), 38.—From a large number of antibiotics and other inhibitory compounds surveyed in detail, several have been chosen for the selective isolation of yeasts and bacteria from the mixed microfloras of apple juices and ciders. Bacteria were isolated on a basal medium of apple juice plus yeast extract, in the presence of actidione and oxine, while a mixture of actinomycin and aureomycin allowed the sole growth of yeasts. Diphenyl was also added to the medium for the suppression of moulds in samples heavily infected with these organisms.

Effect of borates and other inhibitors on enzymatic browning in apple tissue, by Bedrosian, K., *et al.*, *Food Technol.*, 1959, 13 (12), 722.—Many fruits and vegetables are susceptible to rapid discolouration following mechanical or physiological injury. The reaction responsible for this is an enzyme-catalyzed oxidation of phenolic compounds. The purpose of this study was to investigate the properties of boric acid and borate salts as inhibitors of enzymatic browning of apple tissue. Boric acid and borate salts are, of course, not presently approved for use by the Food and Drug Administration. However, the inhibition of enzymatic browning by masking the oxidation site is of interest regardless of the immediate applicability of the particular complexing agent being used. Sodium meta- and tetraborate (STB) were found to be effective inhibitors of enzymatic browning, whereas sodium perborate and boric acid were not effective. Borate activity was not affected by pH. Study of STB with other inhibitors for apple slice browning indicated favourable interaction of STB with sodium diphosphate, ascorbic acid, sodium chloride,

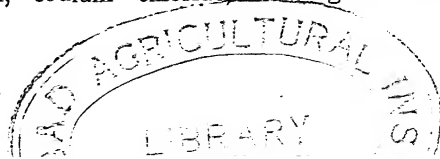
sucrose and sodium bisulfite. Optimum pH range for interaction of ascorbic acid and STB was 5-7. Both sucrose and dextrose were found to be equally effective as browning inhibitors. Activity of sodium bisulfite varied with pH, the optimum being in the acid range. STB was found to exert no detrimental effect on flavour, texture, or off-flavour. The general acceptability study further showed that 0.5 per cent STB plus 100 p.p.m. SO₂ from sodium bisulfite gave uniformly excellent colour protection during the 14-day storage period. The sulfite alone gave fair protection; the combination of STB with ascorbic acid yielded samples slightly below acceptable; and the ascorbic acid alone gave hardly any protection at all.

MICROBIOLOGY

Determination of yeast viability, by Gilliland, R. B., *J. Inst., Brew.*, 1959, 65, (5), 424.—A new technique for the determination of yeast viability, by cultivation of haemacytometer slides followed by counting the microcolonies, gave a demonstrably true estimate of the percentage of cells which were able to reproduce. By comparison with this method, staining techniques correctly estimated the percentage of viable cells in fresh yeasts, but overestimated the percentage of viable cells in old yeasts. Gelatin plate counts always underestimated the percentage viability. With some brewery yeasts it was possible to demonstrate by slide culture that the dilution necessary for a plate count was lethal to a large proportion of the cells. The gelatin plate method therefore gave very low and erroneous results for the viability of these yeasts. Slide culture was also found to be useful for the enumeration of chain-forming yeast in a mixed culture.

OILS AND FATS

Determination of citral in lemongrass and citrus oils by



condensation with barbituric acid, by Levi, L. and Laughton, P. M., *J. agric. Fd. Chem.*, 1959, 7 (12), 850.—Citral is one of the basic raw materials of the essential oil, flavour, and cosmetic industry. Its quantitative determination is therefore of great importance to both producers and processors of aromatic chemicals and related products. When the α , β -unsaturated aldehyde is treated with barbituric acid in aqueous ethyl alcohol, condensation takes place to form citrylidenebarbituric acid. The reaction product displays strong ultraviolet absorption at 336 m μ , and the intensity of the band observed of this wave length, under controlled conditions, is utilized for quantitative measurements. The method should prove useful to the essential oil, flavour, and cosmetic industry for process control and quality evaluation of raw materials and consumer goods.

A new development in vegetable oil refining equipment, by Kaiser, H. R. and Doyle, C. M., *J. Amer. Oil Chem. Soc.*, 1960, 37 (1), 4.—New developments, using the rotating contactor, in the vegetable oil processing industry have been described and illustrated. Results from various refining operations on a number of oils have been presented. Economics from reduction of capital expenditures and operating costs are expected to accrue to the user. He can also choose the process to give those products best suited to the market. The improved rotating contactor offers to the vegetable oil processor a most versatile plant.

A review of some physiological effects of gossypol and cottonseed pigment glands, by Eagle, E., *J. Amer. Oil Chem. Soc.*, 1960, 37 (1), 40.—Untreated cottonseed pigment glands vary widely in their acute oral toxicity in the rat, but

this toxicity is not proportional to their analysed gossypol content. Pure gossypol is toxic to the rat but much less so than any untreated cottonseed pigment glands tested. Repeated doses of gossypol at levels of 10-200 mg./kg./day were fatal to the dog. The acetone-soluble, water-soluble fraction of a sample of cottonseed pigment glands proved to be the most toxic (LD₅₀ 700 mg./kg.) material ever isolated from cottonseed. One fraction, despite a gossypol content of 90 per cent, was only half as toxic as the original pigment glands which contained only 40 per cent gossypol. The toxic factors (s) of cottonseed pigment glands were not extracted by petroleum naphthas or tetrachloroethylene, were partially extracted by ethanol, and were completely extracted by diethyl ether and acetone. Gossypol combination products were considerably less toxic than cottonseed pigment glands and in four out of five cases were much less toxic than gossypol. The order of decreasing sensitivity to cottonseed pigment glands in various animal species was: guinea pig, rabbit, mouse, rat. Long-term storage of cottonseed pigment glands for even as long as 9½ years had little effect on their acute oral toxicity or their analysed gossypol content. Cottonseed pigment glands were slightly less toxic when administered in oil than when they were administered in water. Gossypol, on the other hand, was slightly more toxic when given in oil than when given in water. Pure gossypol fed at various dose levels in the diets of experimental animals caused body-weight depression in proportion to the amount fed. Cottonseed pigment glands fed to experimental animals depressed body weight considerably more than could be explained on the basis of their gossypol content. Feeding cons-

tant levels of gossypol (0.1 per cent supplied by each of six different samples of cottonseed pigment glands) caused varying body-weight depressions, but all six samples caused greater body-weight depression than did any of the three samples of gossypol similarly fed. Cottonseed pigment glands are well detoxified when administered in 2 per cent ferrous sulfate solution. A list of 14 other reagents which cause varying degrees of detoxification of cottonseed pigment glands is given.

PLANT REGULATORS

Preparation and plant growth regulating activity of crude protein hydrolyzate derivatives of DL-2-(2,4-Dichloropenoxy) propionic, by Krewson, C.F., *et al.*, *J. agric. Fd. Chem.*, 1959, 7 (12), 837.—These investigations were undertaken for the purpose of utilizing low-cost protein hydrolyzates made from by-products or readily obtainable protein source materials. DL-2-(2,4-dichloropenoxy) propionic acid (2-(2, 4-DP)), a very active plant growth regulator, was chemically combined with a variety of these materials to determine whether the new products possessed growth-regulating properties that were different qualitatively or quantitatively from the parent acid. In general, coupling of protein hydrolyzates with 2-(2, 4-DP) produced derivatives which induced growth responses suggesting the possible commercial use of the former as agents for the preparation of low-volatile amide herbicides. Although the general response of test plants was somewhat less, corn and cucumber responses were greater, than to the parent acid. Reduction of undesirable formative effects characteristic of phenoxy parent acids may be of interest for other purposes such as induction of fruit development.

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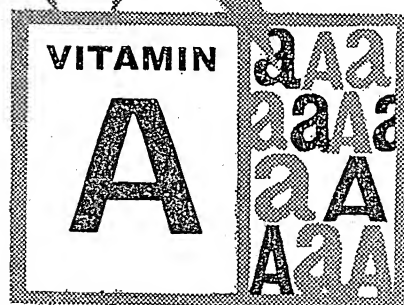
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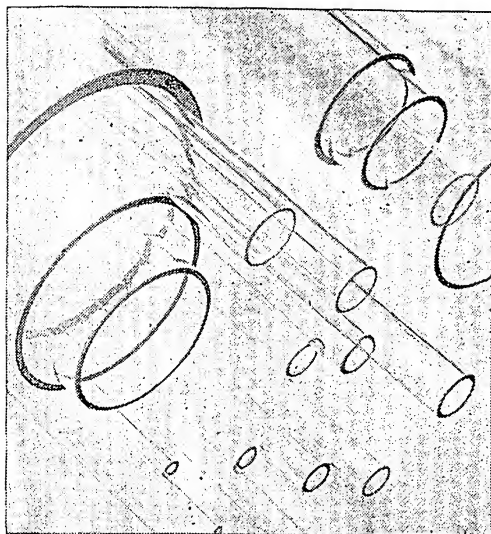
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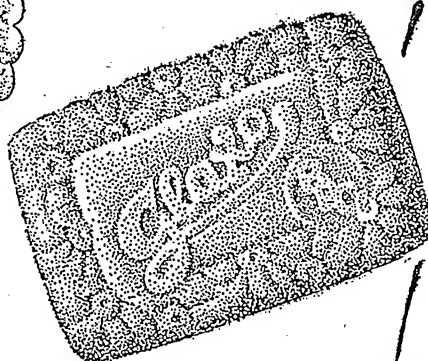
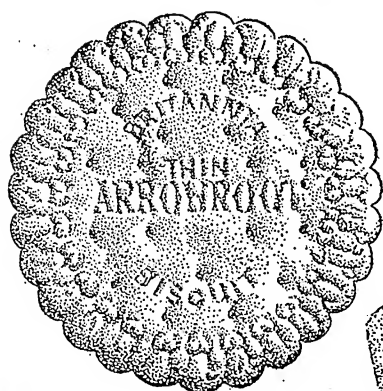
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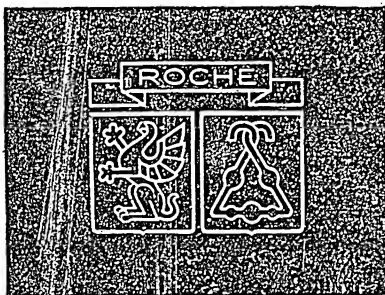
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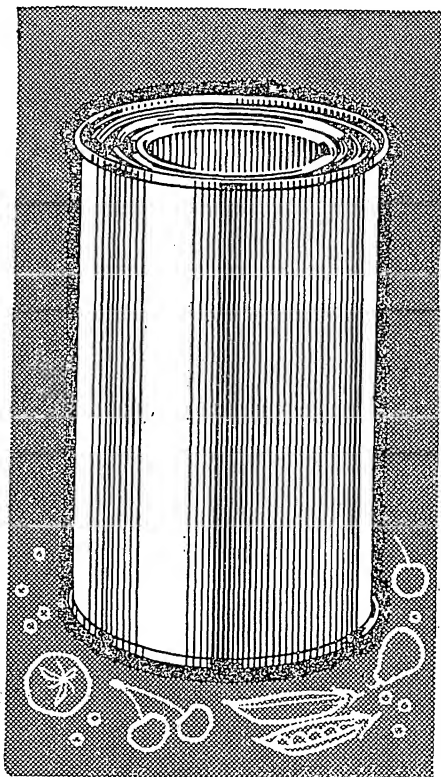
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1. SOME ASPECTS OF FOOD TECHNOLOGY IN INDIA (*published in August 1959*), pp. 160.

This is a publication specially brought out on the occasion of the F.A.O. Regional Seminar on Food Technology for Asia and the Far East held in Mysore from August 1-8, 1959. It is a collection of 26 review articles, which cover exhaustively the research work done in India on some of the important aspects of Food Science and Technology, particularly those dealing with rice and rice substitutes; fruit and vegetable products; dehydration of foods; storage, packaging and transport of perishables; infant, invalid and protein-rich foods; beverages, spices and condiments; etc. The book represents under one cover the important lines of work and progress made in India in the field of Food Technology.

Price: (Bound) Rs. 10.00 (*postage extra*); £1.5.0; \$ 4.00.

(Ordinary) Rs. 5.00 („ „); £0.12.0; \$ 2.00.

2. FRUIT AND VEGETABLE PRESERVATION INDUSTRY IN INDIA (*published in May 1956*) pp. xiv + 485. (Compiled and edited by R. C. BHUTIANI).

This publication is packed with up-to-date technical and statistical data on several aspects of the Fruit and Vegetable Preservation Industry spread over 65 papers read and presented by scientists, technologists, industrialists (manufacturers of food products, machinery, additives, containers and packaging) as well as importers and exporters. Some papers also bring out adequately the various stages of development of the Industry in the country and the handicaps with which it is faced today. The inclusion of the discussions which followed each of the papers read, has added to the usefulness of the book. It also contains the Recommendations of the Symposium submitted to the Planning Commission for consideration in respect of schemes to be included in the Second Five-Year Plan.

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3. TECHNICAL AID TO FOOD INDUSTRIES (*published in July 1954*), pp. xvi + 270.

This publication, contains the views and suggestions of prominent scientists, leading industrialists and food technologists, and Government officials on the nature of technical aid needed by different food industries in the country. Up-to-date technical and statistical data are provided and an appendix embodying the conclusions of the Symposium as well as a comprehensive index are given.

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4. FOOD AND POPULATION AND DEVELOPMENT OF FOOD INDUSTRIES IN INDIA (*published in July 1952*) pp. xv + 357.

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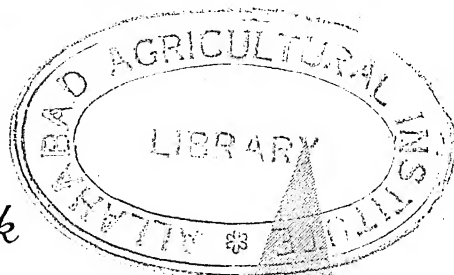
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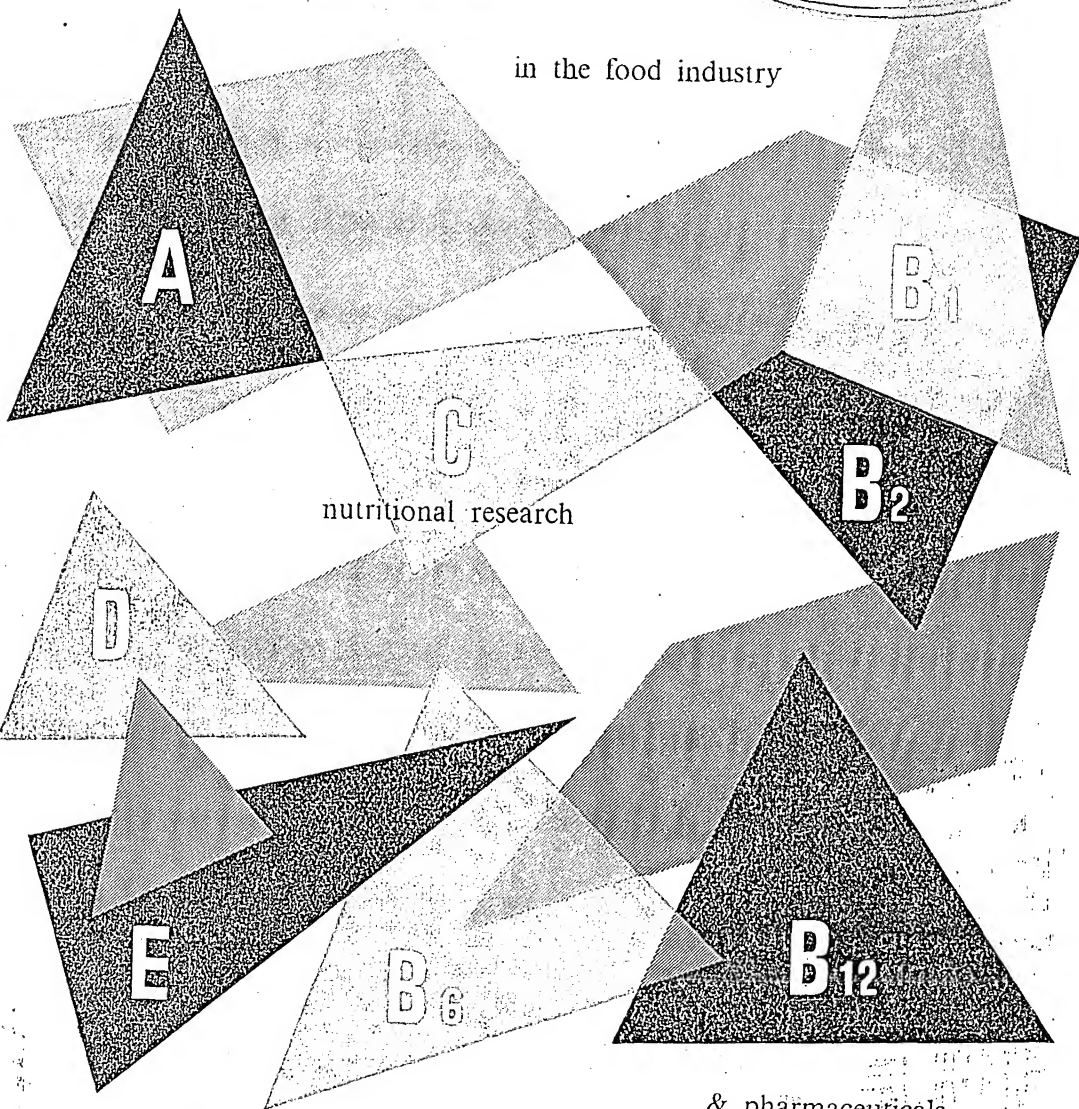
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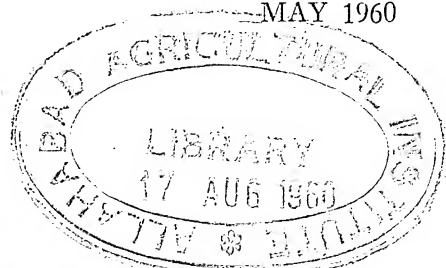
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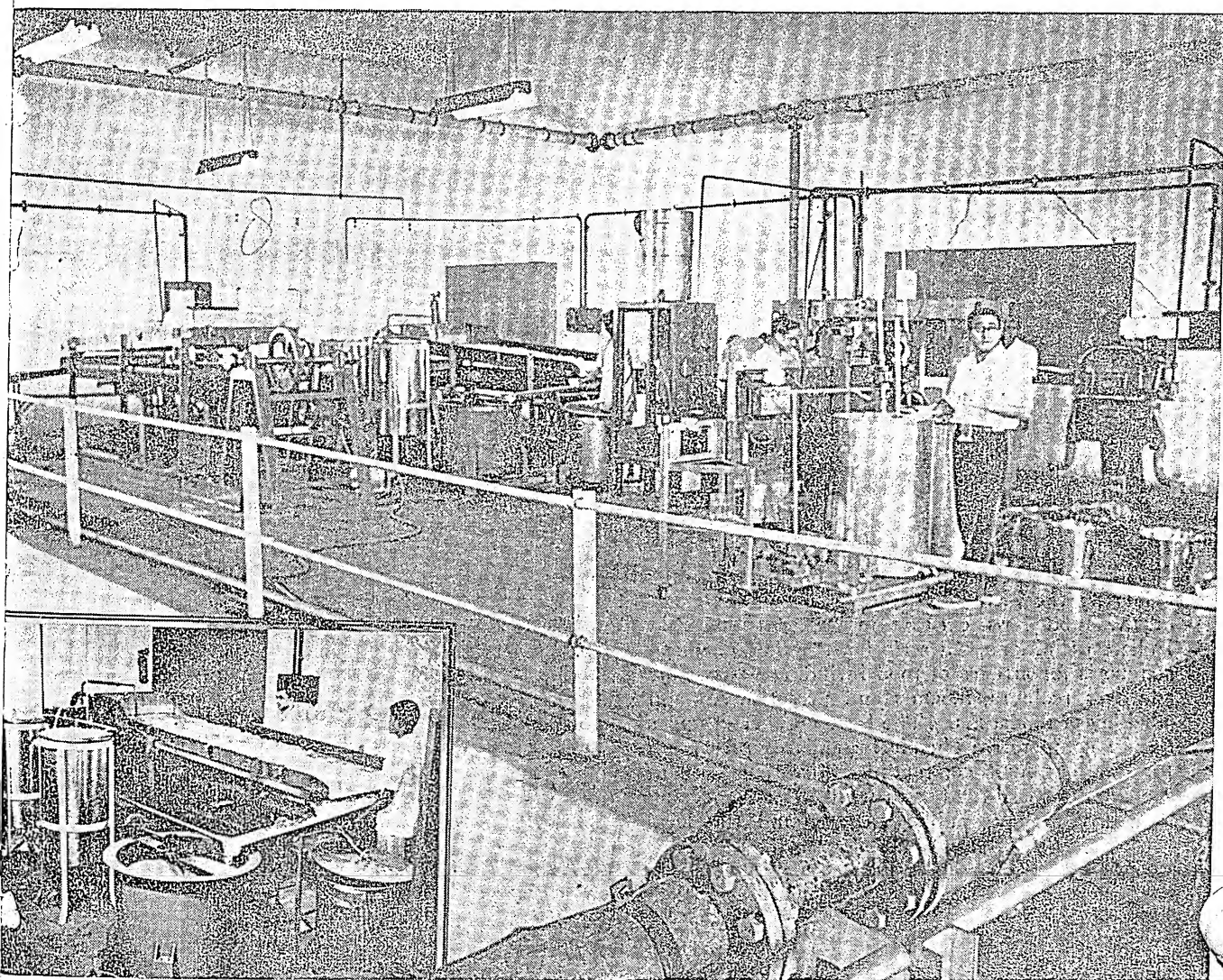
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FOOD

SCIENCE



CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE, MYSORE



INTEGRATED PROCESS OF GROUNDNUT: A general view of the Pilot Plant at the Institute.

C.F.T.R.I. PUBLICATIONS

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3. INDIAN FOOD LAWS (*published in August 1954*) pp. v + 220.

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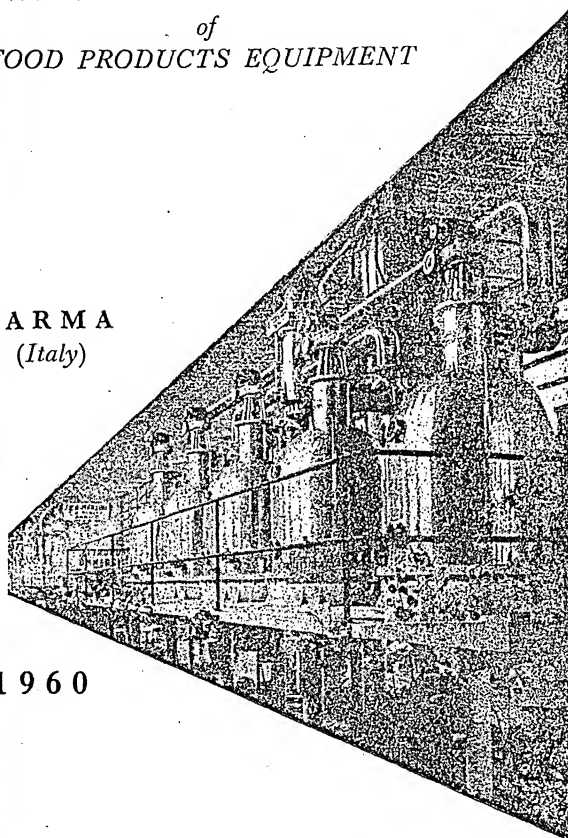
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EFFECT OF PROCESSING AND COOKING ON THE NUTRITIVE VALUE OF 'NUTRO' MACARONI (Protein-enriched macaroni)

By K. M. NARAYANAN, N. RAJASEKHARAN, N. S. KAPUR, G. S. BAINS AND D. S. BHATIA

(Central Food Technological Research Institute, Mysore)

Subrahmanyam *et al.*¹ have recently described the production of tapioca macaroni in the pilot plant set up at the Institute. In another communication from these laboratories, the preparation of enriched wheat macaroni—'Nutro'—from a blend of wheat semolina and low-fat groundnut flour has been reported². Institution feeding experiments conducted by these workers have shown significant improvement in the weight and haemoglobin of children receiving the enriched wheat macaroni over those in the control group receiving rice diet. Since 'Nutro' macaroni contains added vitamins, it was of interest to determine their stability during various stages of the process of manufacture as also during cooking of the finished product and the studies reported here were undertaken in this regard.

Experimental

Raw materials and methods of manufacture: Wheat semolina was obtained from a commercial

flour mill and low-fat groundnut flour was prepared at the Institute¹. The dry mix of wheat semolina (80 parts) and groundnut flour (20 parts) was fortified as follows:

Thiamine 0.5 mg%, riboflavin 1.0 mg%, nicotinic acid 3.0 mg%, vitamin D 135 I.U. % and calcium carbonate 0.9 g%.

Thorough mixing was effected by mixing the ingredients in a mechanical mixer. The pre-mix was then processed in the macaroni plant of the Institute¹ following the standard manufacturing process for wheat macaroni. Bulk samples in rice-shaped grains and in the form of shells were prepared for these studies.

Analytical methods: The proximate chemical composition (Table I) was determined by following standard A.O.A.C. methods³. Thiamine was estimated according to the method of Swaminathan⁴ and riboflavin and nicotinic acid by A.O.A.C. methods³.

Effect of processing on the stability of B-vitamins: Thiamine, riboflavin and nicotinic acid contents of dry macaroni mix and the processed macaroni were estimated to find out the stability of these vitamins during manufacture. The results are given in Table II.

Effect of cooking on the nutritive value of 'Nutro' macaroni: The conventional method of cooking macaroni involves the use of a large quantity of boiling water. If fortified macaroni is cooked in a similar manner and the gruel is not consumed, valuable nutrients will be lost in the gruel. So a few cooking trials were made to determine conditions leading to the minimum loss of nutrients in the gruel. Volume to weight ratios of the two shapes of macaroni, together with loss of nutrients when varying quantities of water were used for cooking are shown in Table III.

After standardizing the cooking conditions, a few trials were conducted to find out the percentage loss of vitamins during cooking. The

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TABLE I. Chemical composition of 'Nutro' macaroni

Shape of the sample	Moisture %	Protein (N \times 6.25) %	Fat %	Ash %	Crude fibre %	Carbo-hydrate (by diff) %	Calcium mg. %	Phosphorus mg. %	Thiamine mg. %	Riboflavin mg. %	Nicotinic acid mg. %
Rice ...	10.9	16.7	3.5	2.0	0.8	66.9	376	250	0.83	1.14	7.56
Shell ...	10.6	16.3	3.1	2.0	0.7	68.0	380	225	0.96	1.14	7.78
Rice and shell ...	13.1	16.6	3.3	2.0	0.8	65.0	380	238	0.86	1.14	7.78

TABLE II. Loss of B-vitamins during the production of 'Nutro' macaroni

Sample		Vitamins per g. (on d.w. basis) (%)						Percentage loss during production		
		THIAMINE		RIBOFLAVIN		NICOTINIC ACID				
		Macaroni mix	Macaroni	Macaroni mix	Macaroni	Macaroni mix	Macaroni	Thia-mine	Ribo-flavin	Nicotinic acid
Rice	...	9.3	8.8	12.8	12.8	84.8	83.0	5.4	Nil	2.1
Shell	...	9.9	9.7	12.7	13.1	87.0	85.3	2.0	Nil	2.0
Shell and rice	...	9.9	9.0	13.1	12.9	89.5	87.7	9.0	1.5	2.0

TABLE III. Loss of nutrients as influenced by increased proportions of water used in cooking

Shape of macaroni	Volume weight ratio ¹	Macaroni: water (by vol.)	Weight after cooking	Total gruel	Loss of solids ² %	Loss of protein ³ %	Loss of calcium ⁴ %
Rice	1:0.83	1:5	512	420	8.94	6.91	3.0
	1:0.85	1:5	790*	210	5.97	4.73	3.0
	1:0.83	1:4	830†	No gruel	...	...	...
Shells	1:0.59	1:5	285	665	8.53	9.43	3.7
	1:0.59	1:3	277	280	8.61	9.82	4.0
	1:0.60	1:2.5	290	190	6.99	9.00	3.6

* Kept $\frac{1}{2}$ hr. in gruel after cooking.

† Kept 1 hr. with gruel after cooking.

¹ Quantity measured by volume (200 c.c.) was taken for cooking in required amount of boiling water.² On the basis of weight of macaroni cooked.³ On the basis of protein content of macaroni.⁴ On the basis of calcium content of macaroni.

vitamin estimations were carried out on the original macaroni, cooked macaroni and the gruel. pH of the gruel was determined by a Cambridge pH meter using glass electrode. The results obtained are shown in Tables IV and V.

Discussion

Table I shows that 'Nutro' macaroni is quite rich in protein, minerals and vitamins. From Table II it will be seen that during manufacture under regulated temperature and humidity, the B-vitamins in the macaroni are not much destroyed except thiamine which shows a loss of 2-9 per cent. Considerable work has been done on the loss of nutrients on cooking in the case of rice and rice products⁵⁻¹¹. Lal and Rajagopalan¹² have described the effect of cooking on the vitamins and minerals of a balanced food composed of oilseed cake proteins. The losses of B-vitamins studied ranged between 5 and 11 per cent.

'Nutro' macaroni can be cooked in the same way as natural rice. It takes about 8-9 minutes for

TABLE IV. *Effect of cooking on the B-vitamin contents of 'Nutro' macaroni (rice)*

No. of trials	Macaroni: water (by Vol.)	Total vitamin in uncooked macaroni (%)	Total vitamin in cooked macaroni (%)	Total vitamin in gruel (%)	Percentage vitamin in cooked macaroni	Percentage vitamin in gruel	Percentage loss on cooking
THIAMINE							
1	1:4	1419	1369	No gruel	96.5	No gruel	3.5
2	1:4	1419	1319	No gruel	92.9	No gruel	7.1
Average	1:4	1419	1344	...	94.7	...	5.3
RIBOFLAVIN							
1	1:4	1881	1862	No gruel	99.0	No gruel	1.0
2	1:4	1881	1785	No gruel	94.9	No gruel	5.1
Average	1:4	1881	1824	...	96.9	...	3.1
NICOTINIC ACID							
1	1:4	12474	12515	No gruel	100	No gruel	...
2	1:4	12474	11775	No gruel	94.5	No gruel	5.5
Average	1:4	12474	12145	...	97.4	...	2.6

(Rice macaroni cooked for 8 min. and kept for 25 min. without disturbing)

TABLE V. *Effect of cooking on the B-vitamin content of 'Nutro' macaroni (shells)*

No. of trials	Macaroni: water (by Vol.)	pH of gruel	Total vitamin in uncooked macaroni (%)	Total vitamin in cooked macaroni (%)	Total vitamin in gruel (%)	Percentage vitamin in cooked macaroni	Percentage vitamin in gruel	Percentage loss on cooking
THIAMINE								
1	1:3	7.02	1032	795	198	77.0	19.1	3.9
2	1:3	7.18	1032	786	189	76.1	18.3	5.6
3	1:3	6.84	1032	786	237	76.1	22.9	1.0
4	1:3	6.84	1032	820	184	79.4	17.8	2.8
5	1:3	7.20	1032	780	175	75.6	16.9	7.5
Average	1:3	7.01	1032	793	197	76.8	19.0	4.2
RIBOFLAVIN								
1	1:3	7.02	1368	1061	330	77.6	24.1	Nil
2	1:3	7.18	1368	1164	201	85.0	14.7	0.3
3	1:3	6.84	1368	1085	...	79.3	...	...
4	1:3	6.84	1368	1128	204	82.4	14.9	2.7
5	1:3	7.20	1368	1119	194	81.8	14.2	4.0
Average	1:3	7.01	1368	1111	232	81.2	17.0	1.8
NICOTINIC ACID								
1	1:3	7.02	9336	7680	1666	82.3	17.8	Nil
2	1:3	7.18	9336	7840	1600	84.0	17.1	Nil
3	1:3	6.84	9336	8192	1611	87.7	17.2	Nil
4	1:3	6.84	9336	8101	1583	86.8	16.9	Nil
5	1:3	7.20	9336	7936	1583	85.0	16.9	Nil
Average	1:3	7.01	9336	7950	1608	85.1	17.2	Nil

(Shell macaroni cooked for 8½ minutes)

cooking after the addition of the product to the boiling water. It has been noted that cooking with just sufficient water does not entail any appreciable loss of nutrients. By cooking macaroni rice with four volumes of water and allowing the cooked product to remain with the gruel for $\frac{1}{2}$ -1 hour, it was observed that practically the whole of gruel is absorbed by the rice grains which swell and become soft. Draining of the gruel is not necessary and the loss of nutrients is avoided. When five volumes of water is used the gruel obtained by immediately draining off the cooked rice results in substantial loss of nutrients but, it could be reduced considerably if draining is done half an hour after the cooking of the product (Table III). Since the volume to weight ratio of the shell macaroni is low it leaves a substantial amount of gruel even on cooking with three volumes of water. It does not absorb the gruel as efficiently as is observed in the case of rice (Table III).

Reference to Tables IV and V reveals that cooking of 'Nutro' macaroni for a period of 8-9 minutes in tap water does not cause any appreciable loss of thiamine, riboflavin or nicotinic acid. During cooking of shells the average losses of thiamine, riboflavin and nicotinic acid in gruel were 19.0, 16.9 and 17.2 per cent respectively, whereas in the rice macaroni there were no such losses of B-vitamins since there was no gruel to drain under the conditions of cooking.

Effect of storage on the stability of vitamins

'Nutro' macaroni was stored in polythene (gauge 250) and paper bags at two temperatures, viz., room temperature (21-30°C) and 37°C at a regulated relative humidity of 70 per cent. The moisture content and pH of the product during the time of storage were 11.8 per cent and 6.1 respectively. The initial values for thiamine, riboflavin and nicotinic acid were 8.3, 11.7 and 101 µg./g. respectively. Every month samples were analysed for thiamine, riboflavin and nicotinic acid by the methods already reported¹.

There is no loss of riboflavin and nicotinic acid under conditions of storage for a period of

more than one year. Thiamine content of the samples progressively decreased with the increase in the storage period. After 12 months of storage the loss in thiamine content is 14.4 per cent at room temperature and 21.7 per cent at 37°C. There was no difference in the percentage losses of thiamine in samples stored in polythene and paper containers.

Summary

Effect of processing and cooking on the nutritive value of 'Nutro' macaroni composed of wheat semolina (80 parts) and low-fat groundnut flour (20 parts) and fortified with vitamins and calcium have been studied. During manufacture under regulated temperature and humidity, the B-vitamins in the macaroni are not appreciably destroyed. Cooking of 'Nutro' macaroni with minimum amount of boiling water reduces considerably the loss of nutrients in the gruel. During a period of 8-9 minutes of cooking there is no appreciable loss of B-vitamins.

Acknowledgement

We are highly grateful to Dr V. Subrahmanyam, Director of the Institute for his keen interest in the work reported here.

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UTILIZATION OF HONEY IN FRUIT PRODUCTS

By B. S. BHATIA, G. S. SIDDAPPA AND GIRDHARI LAL

(Central Food Technological Research Institute, Mysore)

In certain parts of South India especially Coorg, Malnad, etc., large quantities of honey are available. Data regarding its composition, nutritive value and medicinal properties have been reviewed by Bhatia, Subrahmanyam and Srinivasan¹. According to Das and Siddappa² honey can replace with advantage about 50 per cent of sugar in the case of canned bananas and orange segments, but it does not go well with canned pineapples. Bhatia, Siddappa and Lal³ have prepared canned jack fruit of good quality by substituting 12-25 per cent of sugar with honey. Data collected during a study of the possibility of using honey in several other types of fruit products like squashes, crushes, syrups, cordials, jams, jellies, preserves, chutneys and ketchup are presented in this paper.

Experimental

Malnad honey was obtained from the All-India Khadi and Village Industries Board, Dharwar, who stock, (i) wild honey collected from natural bee-hives and (ii) pot honey produced under controlled conditions. The honey was clarified by bringing it to boil and removing the scum. The loss in clarification was about 8 per cent in wild honey and 4 per cent in pot honey. Pot honey, after clarification, was comparatively less viscous and of lighter brown colour than wild honey. Both had a Brix of about 75°. In some experiments, Coorg honey sold by the Coorg Orange Growers' Association in one lb., glass-jar packages was used without further clarification. It was bright orange brown in colour, slightly viscous and of about 80° Brix.

The products prepared using honey (Table I) were stored at room temperature of 24-30°C and examined periodically for their organoleptic quality by a taste panel selected from amongst the staff of the Institute. Squashes, syrups and cordials were tasted after dilution with water to 12.5° Brix.

Results and Discussion

Organoleptic quality of freshly prepared products and after a storage period of about 5-8 weeks at room temperature (24-30°C) was almost

similar and is described in Table I. General conclusions in respect of various categories of products tried may be drawn as follows:

A. *Squashes, crushes and syrups*: (i) FRUIT CRUSHES of 55° Brix prepared from full honeysolids are better drinks than the corresponding squashes of 45° Brix made by using honey.

(ii) FRUIT SYRUPS of 68° Brix with 10 per cent juice have very weak fruit flavour.

(iii) Replacing 25 per cent of sugar solids with honey gives drinks which are comparable to full-sugar drinks.

(iv) Replacing 50 per cent of sugar solids with honey gives fairly acceptable drinks, although they are not quite as sharp in flavour as those with only 25 per cent of sugar replaced with honey.

(v) Honey tends to mask the fruit flavour. This is particularly noticeable in the case of papaya, orange and pineapple squashes.

(vi) Malnad wild honey tends to impart a slight bitter after-taste in the case of squashes, crushes and syrups.

(vii) Coorg honey and Malnad pot honey give comparable products.

(viii) There is a slight sediment at the bottom of the bottle in the case of lime juice cordial where honey is used, and this is undesirable.

B. *Jams and jellies*: Fruit jams set well when the whole or a part of the sugar solids is replaced by honey. In the case of 100 per cent and 75 per cent replacement with honey, the taste and flavour of honey is more pronounced and the colour of the product is comparatively more brown. Fruit flavour is particularly masked by honey in the case of jams from papaya and orange. Replacement of 25 per cent and 50 per cent sugar solids with honey results in jams having a well-blended taste and flavour of fruit and honey. Orange jam gives a jelly of rather thin set. The set can, however, be improved by adding extra pectin.

Guava jelly sets properly upto about 25 per cent replacement of sugar solids by honey. At the 40 per cent level, however, the set becomes thin.

FRUIT PRODUCTS

f products

Remarks
Slightly dull yellow ; flat taste ; mild fruit flavour.
Dull yellow ; flat and very slightly bitter taste ; mild fruit flavour.
Yellow ; characteristic honey taste and flavour but slightly flat ; fruit flavour fairly marked.
do
Characteristic fruit flavour ; sharp taste ; acceptable good drink.
do
do
Dull yellow ; characteristic honey taste and flavour ; mild fruit flavour ; fairly good drink.
Yellow ; characteristic fruit flavour ; sharp taste ; good acceptable drink.
Characteristic honey taste and flavour ; weak fruit flavour ; taste not very sharp ; fairly good drink.
do
Sharp taste ; rather weak fruit flavour ; acceptable drink.
Pale ; marked lime flavour ; sharp taste. Good acceptable drink.
Light brown ; rather flat and very slight bitter taste of honey. Fruit flavour marked.
Dull yellow ; characteristic honey and fruit flavour ; fairly acceptable drink.
Yellow ; characteristic honey and fruit flavour ; acceptable drink.
Pale ; sharp taste and flavour of lime juice, good drink.
Light brown, very slight bitter taste of honey, very slightly flat taste, fruit flavour marked, fairly acceptable drink.
Pale ; good taste and flavour, rather weak lime flavour, good drink.

Name of product
Lime syrup, 68°Brix, 1% acid and 10% juice
do + 300 p.p.m. SO ₂
7 Pineapple squash, 45° Brix, 1% acid, 25% juice and 300 p.p.m. SO ₂
do
do
do
8 Pineapple crush, 55° Brix, 1% acid, 25% juice, and 300 p.p.m. SO ₂
do
9 Pineapple syrup, 68° Brix, 1% acid, and 10% juice
do
do + 300 p.p.m. SO ₂
10 Papaya squash, 45° Brix, 1% acid, 25% juice and 300 p.p.m. SO ₂
do
do
do
11 Papaya crush, 55° Brix, 1% acid, 25% juice and 300 p.p.m. SO ₂
do
12 Sathgudi orange squash, 45° Brix, 1% acid, 300 p.p.m. SO ₂

TABLE I—*Contd.*

Sugar solids (%)	Honey solids (%)	Type of honey	Remarks
...	100	Malnad, wild	Light brown, characteristic honey taste and flavour, fruit flavour very weak.
...	100	„ „	do
100	...	...	Pale, marked pineapple flavour; good, sharp taste, acceptable drink.
...	100	„ pot	Dull yellow, rather flat and very slightly bitter taste flavour marked.
50	50	„ „	Deep yellow, characteristic honey and fruit flavour, less sharp but acceptable drink.
75	25	„ „	Yellow, characteristic honey and fruit flavour, sharp and acceptable drink.
100	...	...	Pale, marked taste and flavour of pineapple, good drink.
...	100	Malnad, pot	Dull yellow, slightly flat and bitter taste. Fruit flavour also present. Fairly acceptable drink.
100	...	„ „	Pale, good drink but fruit flavour weak.
...	100	„ „	Light brown, weak fruit flavour, marked taste and flavour of honey.
...	100	„ „	do
100	...	...	Yellow, mild papaya flavour, fairly good drink.
...	100	Malnad, wild	Dull yellow, characteristic honey taste and flavour. Rather flat taste.
50	50	„ „	Yellow, mild papaya flavour, characteristic honey taste and flavour. Fairly good drink.
75	25	„ „	Yellow, mild papaya flavour. Mild honey taste and flavour.
100	...	...	Yellow, characteristic papaya taste and flavour. Good drink.
...	100	Coorg, pot	Light brown, characteristic honey taste and flavour. Very slightly bitter taste, rather flat. Better drink than 45° Brix squash. Papaya flavour masked by honey.
100	...	...	Pale, characteristic orange flavour, sharp taste, good drink.

TABLE I—Contd.

Name of product	Sugar solids (%)	Honey solids (%)	Type of honey	Remarks
Sathgudi orange squash, 45° Brix, 1% acid, 300 p.p.m. SO ₂	...	100	Malnad, wild	Dull yellow, characteristic honey taste and flavour, rather flat, fruit flavour mild only.
do	50	50	" "	Yellow, characteristic honey taste and flavour, fruit flavour weak, fairly good drink.
do	75	25	" "	Pale yellow, fruit flavour marked, honey taste and flavour mild only. A good drink.
13 Sathgudi orange crush, 55° Brix, 1% acid, 25% juice and 300 p.p.m. SO ₂	100	...	...	Pale, good taste and flavour of oranges. Good drink.
do	...	100	Malnad, wild	Dull yellow, characteristic honey, taste and flavour. Fruit flavour mild only, fairly good drink.
14 Lime juice cordial, 35° Brix, 1.4% acid, 25% juice and 300 p.p.m. SO ₂	100	...	...	Pale, characteristic and sharp taste and flavour of lime.
do	...	100	Malnad, pot	Light brown, characteristic and sharp taste and flavour of lime with honey flavour and slight sediment.
do	50	50	" "	Dull yellow, characteristic and sharp taste and flavour of lime with honey flavour and slight sediment.
do	75	25	" "	Light yellow, characteristic and sharp taste and flavour of lime with honey flavour and slight sediment.
15 Coorg orange jam, 70° Brix	100	...	...	Orange coloured, syrupy, good taste.
do	...	100	Coorg, pot	Brown, syrupy, good honey flavour.
16 Sathgudi orange jam, 70° Brix	100	...	...	Orange coloured, rather thin set, normal orange jam taste.
do	...	100	Malnad, wild	Brown colour, rather thin set, characteristic honey taste and flavour.
do	50	50	" "	Light brown, rather thin set, characteristic honey taste and flavour.
do	25	75	" "	Brown, rather thin set, characteristic honey taste and flavour.
17 Guava jam, 69° Brix	100	...	...	White, characteristic guava flavour, well set.
do	...	100	Malnad, pot	Brown, characteristic guava and honey flavour, guava flavour more pronounced, well set.
do	25	75	" "	Light brown, guava flavour prominent, taste and flavour of honey also present, well set.
do	50	50	Coorg, pot	Brown with whitish guava pieces, good blend of guava and honey flavour, well set.
18 Bangalora mango jam, 68° Brix	100	...	...	Orange colour, good mango taste well set.

TABLE I—*Contd.*

Name of product	Sugar solids (%)	Honey solids (%)	Type of honey	Remarks
Bangalora mango jam, 68° Brix	50	50	Coorg, pot	Brown, good honey and mango taste and flavour, well set.
19 Pineapple jam, 70° Brix	100	...	...	Deep yellow, characteristic pineapple taste and aroma, well set.
do	...	100	Malnad, wild	Brown, taste and aroma of fruit and honey, well set, honey aroma more pronounced.
do	25	75	„ „	Brown, taste and aroma of fruit and honey, honey aroma more pronounced, well set.
do	50	50	„ „	Brown, characteristic taste and aroma of honey and pineapple; well set.
20 Papaya jam, 70° Brix	100	...	...	Orange colour, mild papaya taste and flavour, well set.
do	...	100	Malnad, pot	Brown, mostly taste and flavour of honey, well set.
do	50	50	„ „	Light brown, mostly taste and flavour of honey, mild papaya flavour, well set.
21 Guava jelly, 70° Brix	100	...	...	Deep yellow, well set, marked fruit flavour.
do	50	50	Coorg, pot	Brown, not set.
do	60	40	Malnad, pot	Brown, thin set, characteristic flavour of honey, fruit flavour rather weak.
do	75	25	„ „	Light brown, well set, fruit flavour fairly marked, characteristic mild honey flavour.
do	90	10	„ „	Light brown, well set, marked fruit flavour, honey flavour faint.
22 Carrot preserve	100	...	...	Bright red coloured normal carrot preserve.
do	...	100	Malnad, pot	Brown colour, characteristic taste and flavour of honey.
do prepared in sugar but finally packed in honey syrup	...	...	...	Bright red carrots with brown honey covering it, characteristic taste and flavour of honey.
23 Ashgourd preserve	100	...	...	Pale yellow, normal preserve.
do	...	100	Malnad, pot	Brown, characteristic taste and flavour of honey.
do prepared in sugar but finally packed in honey syrup	...	...	...	Pale yellow fruit covered with brown honey, characteristic taste and flavour of honey.
24 Amla preserve	100	...	Malnad, pot	Light brown, marked fruit flavour.
do	...	100	Malnad, wild	Brown, marked honey flavour.
do prepared in sugar but covered with wild honey	...	...	...	Light brown, marked honey flavour.

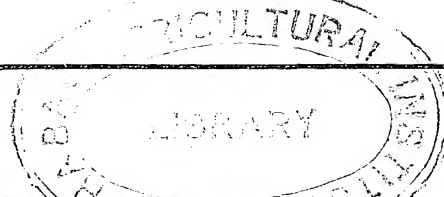


TABLE I—Contd.

Name of product	Sugar solids (%)	Honey solids (%)	Type of honey	Remarks
Amla preserve prepared in wild honey and covered with fresh wild honey	...	100	Malnad, wild	Brown with marked honey flavour.
25 Sweet spiced apple chutney	100	...	" "	All are orange brown coloured and well set. Those with honey have the characteristic taste and flavour of honey and are slightly deeper in colour.
do	...	100	" "	
do	25	75	" "	
do	50	50	" "	
26 Sweet spiced mango chutney	100	...	...	Orange coloured, normal chutney.
do	...	100	Malnad, wild	Orange brown coloured, having characteristic honey taste and flavour.
27 Tomato ketchup	100	...	...	Bright red, normal ketchup.
do	...	100	Malnad, pot	do
do	...	100	Malnad, wild	do
do	...	100	" "	do
do	25	75	" "	do
do	50	50	" "	do
28 Guava cheese	100	...	...	Light brown, normal guava cheese.
do	...	100	Malnad, pot	Orange brown, with characteristic honey taste.
do	50	50	" "	Orange brown with characteristic honey taste.
do	75	25	" "	do

Even as low as 10 per cent replacement imparts the characteristic taste and flavour of honey, and this generally improves the quality of the jelly. Honey also imparts a light brown colour to the jelly and this is not undesirable at all.

C. *Preserves*: Preserves from carrot, ash-gourd and *amla* prepared with honey are brownish and unattractive. If these are, however, prepared with sugar and then finally covered with fresh honey, the final products are good having attractive fruit pieces and the characteristic taste and flavour of honey.

D. *Chutneys*: Sweet spiced chutneys of

good quality can be prepared from apples and mangoes by replacing the whole or a part of the sugar solids with honey. The products have the characteristic taste and flavour of honey. Although of a slightly deeper brown colour, they are quite acceptable.

E. *Ketchup*: Tomato ketchup of bright red colour comparable in quality to normal ketchup can be prepared by replacing the whole or a part of the sugar solids with honey.

F. *Cheese*: Guava cheese of good quality having orange brown colour and characteristic taste and flavour of honey can be prepared by replacing the whole or a part of the sugar solids

with honey. Honey seems to impart the orange tinge to the product.

Quality of products after 45-52 weeks' storage at room temperature (24-30°C): 1. All products with 100 per cent and 75 per cent replacement of sugar with honey were unacceptable because of development of bitter taste of stored honey and dark brown colour, except in the case of tomato ketchup which still retained its bright red colour and had only a faint taste of honey.

2. Products with 25 per cent of sugar replaced with honey were quite comparable in quality to full-sugar products. In the case of passion fruit squash particularly this seemed to help in better retention of the flavour of the fruit.

3. Although some of the products with 50 per cent of sugar solids replaced with honey were found to be of reasonably acceptable quality, the majority of tasters did not consider them as high-class products.

Summary and Conclusions

1. Fruit squashes, crushes, syrups, jams, jellies, chutneys, preserves and guava cheese of

good quality can be prepared by replacing sugar solids with honey upto about 25 per cent.

2. Replacement of sugar with honey at 50 per cent level gives reasonably acceptable products but they are not as good as those with 25 per cent replacement.

3. In the case of tomato ketchup all or part of sugar may be replaced with honey.

4. The products keep well at room temperature of 24-30°C for about a year.

Acknowledgement

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SOME TECHNOLOGICAL ASPECTS OF MANUFACTURE OF MANDARIN ORANGE CONCENTRATE

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While there is voluminous literature now available on different aspects of citrus concentrates, the published information on the physico-chemical changes during commercial scale vacuum concentration of citrus juices is rather scanty¹⁻⁴. Thus, Curl¹ presented only partial analysis of orange juice at 7 different stages of concentration, but this report does not cover some of the important aspects of concentration *viz.*, changes in viscosity, pH, true ascorbic acid, etc. Siddappa and Bhatia² reported only ascorbic acid changes during laboratory scale vacuum concentration (in glass apparatus at 50-55°C) of 3 varieties of Indian oranges (one variety of sweet orange and two of Indian mandarins). Evidently, the conditions of concentration described² are much different from those in commercial practices.

Very recently, Pruthi³ covered practically all the important aspects, *viz.*, changes in °Brix, acidity, pH, viscosity, true ascorbic acid, colour, etc., during commercial scale vacuum concentration of Valencia orange juice³ and lemon juice⁴. No such published information covering all the above aspects of mandarin orange concentrate is available. The present report covers these aspects.

Besides, *gelation* in citrus concentrates is attributed mostly to *pectin methylesterase activity* in the juice. While in other countries, some studies have been reported on the specificity⁵ and time and temperature of inactivation of this enzyme⁶⁻⁸ in different citrus juices, but no such published information is available on the distribution of this enzyme in different component parts of the Indian

mandarin orange and its thermal stability in mandarin orange juice which has rather high pH (3.85-3.90). The present investigation was therefore undertaken to determine optimum time and temperature of inactivation of pectin methylesterase (PMU) in Coorg mandarin orange juice prior to its vacuum concentration, for the manufacture of orange concentrate.

Experimental

(i) *Extraction of juice*: The studies were made on 4 occasions in the season (1958-59). Healthy, medium sized, ripe Coorg mandarin oranges purchased from the local (Mysore) market were employed for the manufacture of orange concentrate. The fruits were washed, hand-peeled and the individual segments were separated. The adhering albedo threads were removed as far as possible. The segments were then soaked in 1 per cent HCl solution for one hour, washed in water and lye-peeled by dipping in 1 per cent NaOH solution at 180°F for 20-25 seconds. The segments were then immediately washed free of alkali in flowing cold water, rinsed in 1 per cent citric acid solution and again washed in water. The lye-peeled segments were passed through a motorized pulper fitted with 1 mm. stainless steel sieve for juice extraction. To further lower the pulp content to less than 10 per cent v/v, the juice was passed through 30 mesh sieve. One tenth of the volume of the entire juice was reserved as 'cut-back' juice. The rest of the juice was quickly heated to 95°C and held at 95°C. for 8 seconds in an open kettle to inactivate the pectin enzyme (pectin-methylesterase) and the juice was then quickly cooled to the room temperature.

(ii) *Pectin-methyl-esterase activity*: Prior to vacuum concentration of orange juice, pectin-methyl-esterase activity (PMU) was determined⁹ by titrating 5-10 ml. aliquots of freshly extracted or heated Coorg mandarin orange juice (depending upon their relative enzyme activity) with 0.1N NaOH to pH 7.5 in the presence of 20 ml. portions of 1 per cent pectin in 0.25 M. NaCl solution. Exactly after 30 minutes, they were titrated with 0.01N NaOH to pH. 7.5 with a view to neutralizing the carboxyl groups liberated by the enzyme. The results were expressed¹⁰ as

mg. of methoxyl liberated in 30 minutes per ml. of enzyme preparation. The data on the retention of pectin methylesterase activity in Coorg mandarin orange juice when heated for different periods at different temperatures have been illustrated in Fig. 1. Besides, the distribution of the pectin methylesterase activity (PMU) in different parts of the mandarin fruit, *viz.*, peel, pomace, seed and juice was also determined and the results of two experiments with mean values are presented in Table I.

TABLE I. *Distribution of pectin-methyl-esterase in different parts of the mandarin fruit*

No.	Fruit components	*P.M.U. Determinations		
		I	II	Mean
1	Juice	0.39	0.59	0.49
2	Pomace	1.98	2.41	2.19
3	Seeds	1.25	2.27	1.81
4	Peel	2.17	2.55	2.36

* Expressed as mg. of methoxyl liberated in 30 min. per g. or ml. of the fruit component.

(iii) *Vacuum concentration*: The juice was concentrated in a forced circulation evaporator (Plate I), with external calandria having 2 sq. ft. heating surface, using a positive displacement pump giving an apparent velocity of 0.5'/sec. The evaporator was worked under absolute pressure of 8-10 p.s.i.g. The technical working details of the four runs on vacuum concentration in this evaporator are presented in Table II.

(iv) *Methods of analysis*: Physico-chemical changes were studied at three stages during commercial scale vacuum concentration as reported in Table III. °Brix, acidity, pH, and carotene were estimated by the A.O.A.C.¹¹ methods. True ascorbic acid was determined colorimetrically by the formaldehyde condensation method¹² which corrects for the interference by reductones which might have been produced during concentration of the juice. Colour of the juice and of the concentrate prepared therefrom was measured in a Lovinbond Tintometer and the *vis-*

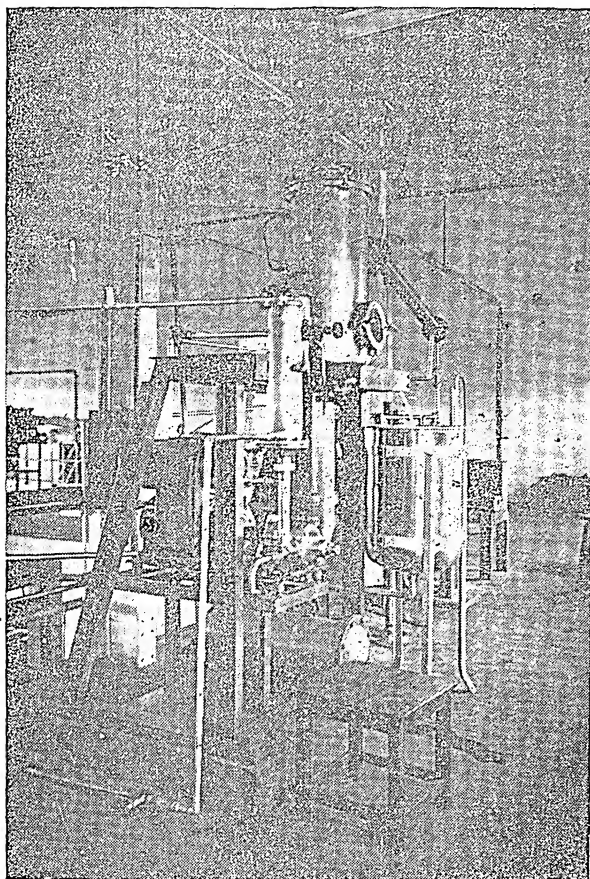


PLATE 1. Forced-circulation evaporator (designed and fabricated at C.F.T.R.I.) employed during the present studies on vacuum concentration of Indian mandarin orange juice.

cosity of the juice and concentrate was measured in an *Ostwald viscometer* No. 2 and 3 respectively.

Discussion

(i) *Pectin-methyl-esterase activity*: Studies on the heat inactivation of pectin-methyl esterase in mandarin orange juice (Fig. 1) revealed that its 100 per cent destruction could be obtained by heating the juice for about 8 seconds at 96°C, for 70 seconds at 90°C, for 100 seconds at 85°C and for 110 seconds at 80°C. For commercial scale vacuum concentration of mandarin orange juice, an optimum time of 8-10 seconds at 95-96°C is suggested and was followed during subsequent studies.

Data on the comparative distribution of PMU in different component parts of Coorg mandarin

orange (Table I) revealed that PMU was maximum in the peel and minimum in the juice.

(ii) *Co-efficient of heat-transfer during vacuum concentration*: From the data given in Table II, on feed rate, steam-temperature, vacuum and other details of the final product, the co-efficient of heat-transfer during vacuum concentration was worked out, which varied from

TABLE II. Performance tests on forced circulation evaporator (Plate 1)

Experiment: Vacuum concentration of Coorg mandarin orange juice

Particulars	Number of runs			
	I	II	III	IV
1. Feed (orange juice)				
i. Quantity (lb.) ...	116	148	118	52
ii. °Brix ...	10.0	11.0	10.5	11.0
iii. Temperature °C ...	45	22	38	36
iv. Viscosity* No. 2 ...	45 sec.	...	...	...
No. 3 ...	9 sec.	...	...	...
2. Feed rate:				
i. Time of start ...	2.30 p.m.	10.15 a.m.	3.20 p.m.	11.50 a.m.
ii. Time of finish ...	4.00 p.m.	11.45 a.m.	4.50 p.m.	12.40 p.m.
iii. Time taken (Hr.) ...	1.5	1.5	1.5	0.83
iv. Feed rate (lb/hr.)...	77	98.7	78.7	62.0
3. Steam pressure (lb.) ...	10	10	8	8
4. Steam temperature (°F)	240	240	233	233
5. Vacuum (in. Hg.) ...	26	26	26	26
6. Final product:				
i. Concentration temperature (°C)	44-45	35	38	36
ii. °Brix ...	52	48	50	50
iii. Quantity (lb.) ...	21.5	29.8	23.0	11.5
iv. Viscosity† (42 °Brix)	13.5 min.	...	...	...
7. Cooling:				
i. Water temp. (°C) (In)	28	27	32	30
ii. Water temp. (°C) (Out)	36	35-36	35	36
iii. Rate of water flow (gallons/hr.) ...	300	310	300	300
8. Co-efficient of heat-transfer (μ) Btu/hr. sq. ft. °F ...	240	360	260	200

* Efflux time in seconds by Ostwald's viscometer No. 2 at 25°C.

† Efflux time in minutes for Coorg Orange concentrate (42° Brix) through Ostwald viscometer No. 3. The efflux time for water through viscometer Nos. 2 and 3 was 13 and 7 seconds respectively.

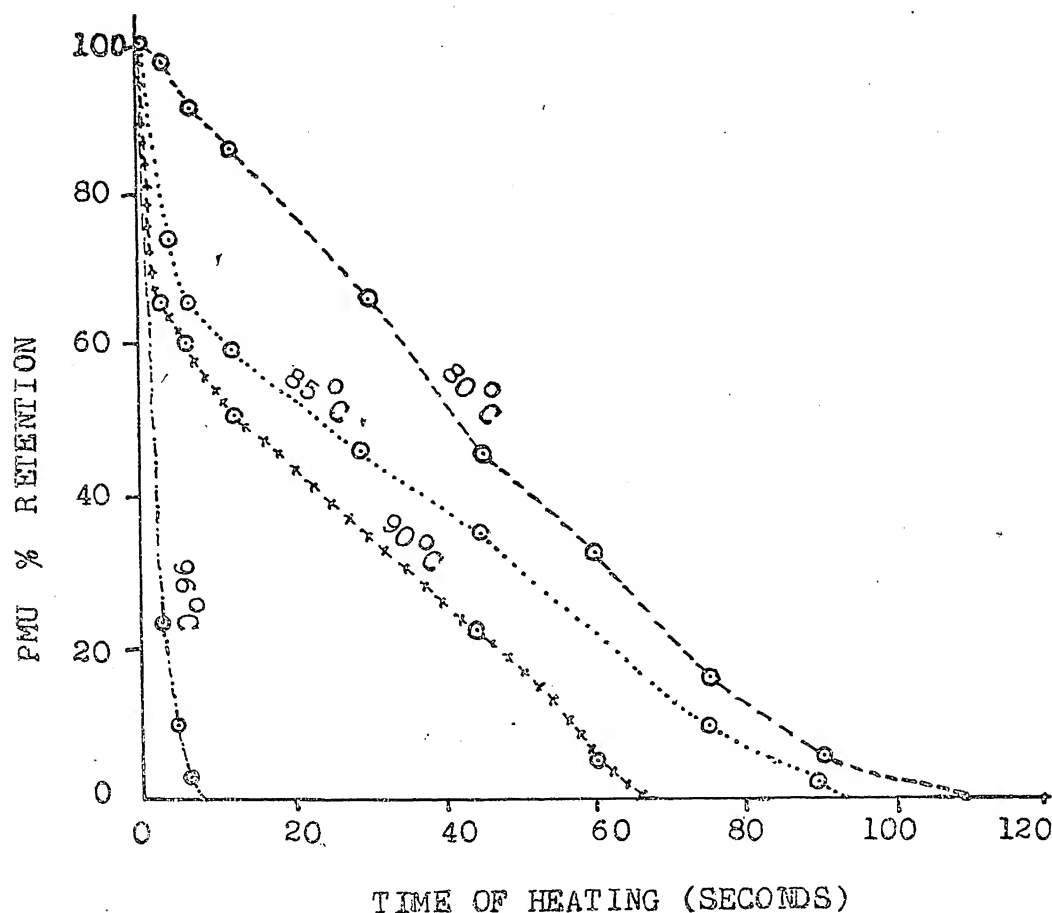


FIG. 1. Retention of pectin-methyl-esterase activity in Coorg mandarin orange juice when heated at different temperatures.

200-300 Btu/hr. sq. ft. °F, depending upon the nature and viscosity of the juice employed and the conditions of concentration in each batch.

(iii) *Physico-chemical changes during vacuum concentration:* A study of Table III, will reveal that with the advancing concentration, there was a gradual increase in Brix, acidity and ascorbic acid content, on change in Brix/acid ratio, but a gradual, though a slight, fall in pH. Thus, during approximately five-fold concentration (Stage III), the pH came down from 3.85 to 3.70 with the corresponding increase in the acidity from 0.69 to 3.05.

Viscosity: It would not be desirable to carry on concentration beyond 5-fold, because as a result of high viscosity in the product, there would be lower rate of heat-transfer resulting

in a product of inferior colour, flavour and nutritive value.

Colour: There was some change in colour of the juice during concentration. Thus the yellow unit increased from 13.1 to 19.8, while the red units increased from 3.0 to 6.9.

Sugars: There was slight increase in reducing sugars, during concentration, whereas the total sugars remained almost constant. The degree of inversion increased from 30.31 to 41.60 per cent during concentration.

Carotene: The losses in carotene during five-fold concentration were 4.6 per cent only.

Ascorbic acid: There was a small amount of apparent ascorbic acid present in the fresh single strength juice while at different stages of concentration, it ranged from 5.9 to 9.7 per cent. The

TABLE III. *Physico-chemical changes in Coorg mandarin orange concentrate during commercial scale vacuum concentration*

Physico-chemical characteristics	Stages of concentration		
	I	II	III
1. Refract. solids% ...	11.30	35.40	50.30
2. Acidity % (w/w*) ...	0.69	2.14	3.05
3. °Brix (Corrected)† ...	11.44	35.59	50.84
4. Brix/acid ratio ...	16.5	16.5	16.5
5. pH ...	3.85	3.80	3.70
6. Concentration ratio: w/w ...	1.0	3.10	4.42
v/v ...	1.0	3.69	5.48
7. Reducing sugars % ...	3.25	12.75	19.60
8. Total sugars % ...	10.72	33.4	47.11
9. Non-reducing sugars % ...	7.09	19.63	26.13
10. Degree of inversion % ...	30.31	38.17	41.60
11. Colour (Tintometer):			
i. Yellow units ...	13.1	16.1	19.8
ii. Red units ...	3.0	3.9	6.9
12. True ascorbic acid (mg./100 g.) ...	20.5	58.48	81.83
13. True ascorbic acid (as per cent total) ...	94.1	92.4	90.3
14. Losses in ascorbic acid % ...	0.00	7.9	9.3
15. Carotene (mg./100 g.) ...	0.55	...	2.31
16. Losses in carotene % ...	0.0	...	4.61
17. Viscosity (centipoises) ...	1.0	80	200

* As anhydrous citric acid.

† Corrected for temperature and citric acid.

per cent losses upto fivefold concentration amounted to 9.3 per cent only. However, when the product temperature during concentration was 45°C or above the losses in vitamin C were of the order of 18.0 per cent.

In conclusion, the product retained most of the nutrients during concentration and had a fairly attractive appearance. However, it somewhat lacked in the natural flavour which is mostly due to the volatile oil, most of which unfortunately gets evaporated during vacuum concentration. It was, therefore, considered desirable to restore the flavour of the concentrate by adding optimal dose of freshly extracted cold pressed mandarin peel oil to the concentrate or the juice reconstituted therefrom. As a result of these experiments¹³, the optimum level of addition of orange oil to the reconstituted juice was found to be 0.02 per cent (v/v) or 0.08 per cent to the concentrate itself.

Comparing Indian mandarin orange concentrate with Valencia orange concentrate³, some characteristic differences were noted, *viz.*, man-

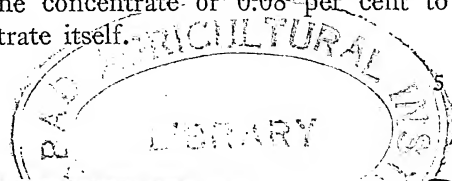
darin orange juice and concentrate had much lower acidity and ascorbic acid but slightly higher °Brix/acid ratio and pH than Valencia orange juice and concentrate. Further, the losses in ascorbic acid during vacuum concentration were higher (about 9.3 per cent) in mandarin orange juice than in Valencia orange juice (4.85 per cent). This may partly be attributed to the higher pH of the former and partly due to the different evaporators used. Further, mandarin orange concentrate had comparatively less flavour than Valencia orange concentrate¹⁴ because of the very low initial oil content. However, its flavour could be improved by fortifying it with desired quantity of mandarin peel oil.

Summary

Detailed physico-chemical changes in Coorg mandarin orange juice during commercial scale vacuum concentration in a forced-circulation evaporator (fabricated at the Institute) have been studied and discussed. The various aspects covered are pectin-methyl esterase activity, heat-transfer co-efficient and changes in °Brix, acidity, pH, viscosity, true ascorbic acid, carotene, colour, etc.

For 100 per cent heat inactivation of pectin methyl-esterase (PMU) in Coorg mandarin orange juice, an optimum heating time of 8-10 seconds at 95-96°C has been suggested. The data on distribution of PMU in different component parts of mandarin orange revealed that PMU was maximum in the peel and minimum in the juice.

The co-efficient of heat-transfer during vacuum concentration of mandarin orange juice ranged between 200-300 Btu/hr. sq. ft.°F., depending upon the initial pulp content and viscosity of the juice employed. The per cent losses in carotene and ascorbic acid during concentration were of the order of 4.6 and 9.3 per cent respectively. The orange juice retained most of the nutrients during concentration and had an attractive appearance, but it somewhat lacked in natural flavour of the parent juice. However, the normal flavour could be restored by the addition of 0.02 per cent of freshly extracted cold pressed orange peel oil to the juice reconstituted from the concentrate or 0.08 per cent to the concentrate itself.

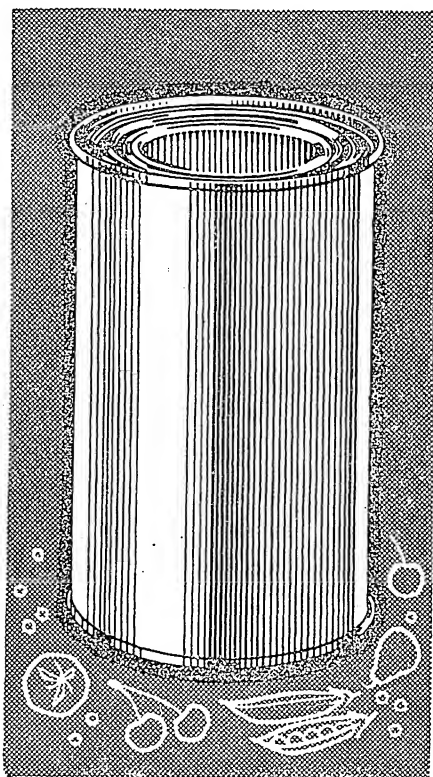


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Aiyars

Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during April 1960 are given in this section.

S (IS) 11

Utilization of citrus waste—an integrated process for the recovery of oil and pectin, by C. M. Parekh (*April 2, 1960*).—Emphasizing the importance of citrus fruits in the national economy of the country, the speaker remarked that with respect to both acreage and production, citrus fruits rank third among the fruits grown in India. Of the citrus fruits, mandarin (loose skin orange) and sweet oranges constitute the major group. Considerable amount of citrus waste (mainly from loose skin orange and limes) from the Indian fruit preservation industry is available for utilisation. Besides, culls and unmarketable surplus fruits from the farms are estimated to be available to the extent of about 20-25 per cent of the total citrus fruit production in India. At present, only a small quantity of waste from citrus processing industry is being utilized either for the manufacture of marmalades or by the distilleries and to some extent, for getting cold pressed essential oil from peels, while the surplus citrus fruits from the farms go mostly unutilized. Reviewing the literature briefly, the speaker remarked that earlier research work in India was concentrated only on one of the two important products of citrus waste, namely, pectin or oil. No systematic work has so far been carried out on the integrated process for the recovery of both oil and pectin from citrus waste available in India.

Further, the major bottleneck in the successful utilization of citrus waste in India is that unlike other advanced countries, the citrus waste available in individual fruit preservation factories is comparatively too small to start independent-

ly a by-product industry unless a co-ordinated effort is made to collect the citrus peel—fresh or exhausted dried peels—in considerable quantity so that it could be utilized for oil as well as pectin. Keeping this in view, experiments were planned to utilize citrus waste for the recovery of oil and pectin to suit the peculiar conditions prevailing in the Indian fruit preservation Industry.

Mr Parekh then presented and discussed the results of the experiments carried out on the integrated process for the recovery of essential oil and pectin. He pointed out that the recovered essential oil and pectin together required certain precautions for obtaining high quality as well as maximum yield. The presence of pectic enzymes causes difficulties in the preparation of high grade pectin. Further, orange peels are sometimes given certain treatments such as steeping in calcium salt solutions in order to get higher yield of oil by hardening the tissues of peels, but the presence of even small amount of calcium salts renders the exhausted peel (oil extracted peel) unfit for the recovery of good quality pectin. Of the various treatments tried for the optimum recovery of oil and pectin without affecting the quality, the best treatment was to soak the fresh peels in 5 per cent sodium chloride solution for one hour prior to the extraction of oil, then intermittent blanching of the exhausted peel twice in boiling water for 2-3 minutes and subsequent immersing them each time in cold water for 2-3 minutes. This method could be adopted to recover maximum oil as well as pectin without sacrificing their quality. The speaker also pointed out that use of dried, unexhausted

peels resulted in oil of poor quality and low yield. However, after expressing the oil from the fresh peels and subsequent blanching, the exhausted peels could be dried during the glut season and used for the subsequent recovery of pectin. He further mentioned that citrus pomace (seeds and rags) were also rich in pectin and could be used when fresh or after drying for the recovery of pectin. Prior to the extraction of pectin from pomace, it is essential to blanch it in order to inactivate the pectic enzyme. It is also essential to wash the blanched pomace in liberal quantity of water in order to leach out most of the water solubles. Drying of the exhausted peels or pomace after blanching does not significantly affect the quality and yield of pectin. The pectin from the peels and pomace in fresh or dried state could be recovered by the alcohol or the aluminium chloride precipitate methods. The latter method resulted in a coloured precipitate which may perhaps be attributed to the complex formation between the flavonoids and the aluminium ions. By repeated washing of the precipitate with alcohol and initial blanching of peels, it is possible to get rid of the colour. The suggested technique of expressing oil from fresh peels yields one per cent oil. Likewise, the recovery of pectin from exhausted mandarin peel and pomace was 12-13 per cent and 21-23 per cent on dry weight basis, with a jelly grade of 200-225 and 150-175 respectively.

The speaker then discussed the results of experiments carried out on lime-juice-pressed-residue (pomace) and lime pulp waste (a discarded settled pulp from cordial preparation). The pomace could be

utilized for the pectin recovery after blanching and washing out sufficiently with water to leach out soluble material. The fresh lime pomace could be used directly for pectin extraction or may be dried and subsequently used for the pectin extraction at convenience. The lime pomace yields on dry weight basis 17-21 per cent pectin of 275-300 jelly grade. The lime pulp waste is quite rich in oil which is incorporated into it from the peels during the extraction of lime juice. Based on experimental results, the speaker indicated that there was a possibility of recovering the oil from lime pulp waste to the extent of 20 per cent of total oil present in the pulp by using efficient centrifuges. The rest could be recovered by strip column continuous distillation method which is rapid as well as economical as compared to the conventional method of still steam distillation of oil. After recovery of the oil from waste lime pulp, the pulp is allowed to stand for 36-48 hours after which clear liquid is decanted off. This liquid contains 4-4.5 per cent citric acid and as such it could be utilized for the recovery of citric acid. The residual pulp is mixed with the residual pomace (from which oil and pectin have been extracted), dried and utilized as a cleaning mixture for utensils, etc.

The speaker then suggested that in a citrus juice processing industry, the oil from mandarin peels could be recovered by employing cheaper type of roller press (hand or motor driven) designed and fabricated at this Institute and that the exhausted peels and pomace, after inactivating pectic enzymes present in them, should be dried in the sun or in a dehydrator. Subsequent recovery of pectin from such dried peels may be made in a 'Pectin Manufacture Factory' sponsored on a co-operative basis by fruit preservation industries.

As regards the utilization of farm surplus and cull fruits, the oil may be recovered from the peels and the exhausted peels blanched and dried in the sun or dehydrator.

The dried peels may be transported to a central factory for pectin manufacture.

Need for extensive survey to find out the practicability of the process, reason for the methoxyl value going down by lime treatment, need for carrying out large scale trials, effect of storage of dried peels for long periods on the recovery and quality of pectin, amount of citric acid in the lime pomace, whether any microbial deterioration causing low jelly grade of pectin was observed, difficulty in drying the peels and pomace during rainy season, effect of maturity of the fruit on the quality of oil, feasibility of mixing exhausted peels of different citrus fruits for pectin recovery, explanation for the low yield of oil from dried peels, etc., were some of the important points raised during the discussion.

The President commending the investigation as an interesting piece of work, said that large quantity of raw material is available in places like Coorg and Assam and that collaboration from the industry and the growers was forthcoming now. There are plenty of pectinous material available in the country which should be exploited. He emphasized the need for carrying out large scale trials to make the method foolproof so that the industry could take it up. We could have a few roller presses which could be taken to the citrus growing area and demonstrate to the people the simple method of expressing the peel oil.

S (IS) 12

Studies on the preparation and nutritive value of spray-dried vegetable milk powder, by S. R. Shurpalekar (*April 14, 1960*).—Introducing the subject, the speaker said that although India ranks third in the world in the production of milk, the *per capita* consumption was very much lower than the optimum requirements for a well-balanced diet. An increase in the production of milk sufficient to provide the minimum requirements of the population

of India does not appear to be practical in the near future. The high inadequacy of milk also exists in other Asian countries, Africa and Latin America.

Consequently, there is an urgent need to develop highly nutritive and low cost milk substitutes of vegetable origin to supplement the diets of infants, children and other vulnerable sections of the population. The reasons for developing the milk substitutes can be summarised as follows:

- (1) Inadequate and uneven production of milk in the country.
- (2) The high cost of milk and its non-availability to the low income groups of the population.
- (3) The high incidence of malnutrition among weaned infants, young children and the vulnerable sections of the population.

In addition to the above, infants and children allergic to cow's milk need milk substitutes of vegetable origin. In view of the poor keeping quality and difficulties involved in the transport of liquid milk, it is all the more important to develop a milk substitute in dried form.

After reviewing the work on milk substitutes as already reported by different research workers in various countries, the speaker gave in detail an account of the various investigations carried out on the preparation and nutritive value of spray-dried powder obtained from a blend of soyabean and groundnut milks.

The speaker giving an outline of the preparation of vegetable milk powder said that soyabean milk was prepared by dispersing the paste of soaked, dehusked and debittered soyabeans in water. Groundnuts were decorticated, soaked and decuticled. Milk was obtained by dispersing the partially defatted groundnut paste in water. The two emulsions were combined, pH was adjusted and the combined emulsion centrifuged to remove starch and fibre. It was then steam-

ed to destroy the trypsin inhibitor. Salts and sugar were added, pH was adjusted and the emulsion was concentrated under vacuum in forced circulation evaporator, homogenised and spray-dried. The vegetable milk powder thus obtained was fortified with vitamins. Soyabean milk powder and groundnut milk powder were also prepared by spray-drying the respective milks.

Using the vegetable milk powder, animal experiments were carried out to assess the nutritive value of the product. Modified cow's milk powder—a blend obtained by mixing 70 parts of whole milk powder, 16 parts skim milk powder and 14 parts of powdered cane sugar—was used as control in the animal experiments. An admixture of 4 parts of vegetable milk powder and one part of modified cow's milk powder was also included in the investigation. As methionine is the only limiting amino acid in the proteins of vegetable milk powder, a portion of vegetable milk powder fortified with *dl*-methionine, so as to raise the level of methionine to 3 g. per 16 g. nitrogen was also included in the study.

In the animal experiments carried out to assess the overall growth promoting rate, rats were fed *ad lib* on different milks obtained by reconstituting one part of respective milk powder with 6 parts by weight of water. The results of 8 weeks' feeding trial showed that the milk reconstituted from vegetable milk powder containing 3.5 per cent protein promoted a fairly good growth of 13.3 g./week in albino rats. This growth was, however, significantly less than that observed with reconstituted modified cow's milk (17.1 g./week). A 4:1 blend of vegetable milk and modified cow's milk, and vegetable milk supplemented with methionine brought about significant increase in the weekly growth promoting rates (16.1 g. and 16.6 g. respectively).

Further, there was no significant difference in the haemoglobin level and RBC count of the blood and

the mean moisture and fat contents of livers and carcass of rats fed on different milks. However, the mean protein content of livers and carcass of rats fed on vegetable milk was significantly less than those of the livers and carcass of animals fed on modified cow's milk. It is of interest to note that there was no significant difference in the mean weekly gains in weight and mean protein contents of livers and carcass of rats fed on: (1) vegetable milk fortified with methionine; (2) a 4:1 blend of vegetable milk and modified cow's milk and (3) modified cow's milk.

A similar trend was also observed in different groups of animals with respect to protein retained per 100 g. increase in body weight.

The results of the experiment carried out to assess the effect of fortification of vegetable milk powder with *dl*-methionine on the protein efficiency ratio of its proteins, revealed that P.E. ratio of proteins of vegetable milk powder (1.56) was significantly less than that of the proteins of modified cow's milk powder (2.24). Blending of vegetable milk powder with modified cow's milk powder in the ratio of 4:1 increased the P.E. ratio significantly (1.90). Fortification of vegetable milk powder with *dl*-methionine also brought about a similar increase in P.E. ratio (2.06).

The speaker concluded by saying that the nutritive value of (1) vegetable milk powder supplemented with methionine; (2) a 4:1 blend of vegetable milk powder and modified cow's milk powder, when suitably fortified with lacking nutrients such as vitamins and minerals compares favourably with the nutritive value of animal milks.

Some of the important points raised related to the palatability of the milk blend, milk intake of rats, stability of the vegetable milk powder, need for using higher proportions of groundnut in the blend in view of the meagre production of soyabeans, methods of adjusting the composition of soya and groundnut milk powders, need for fortifying the powder with

vitamin B₆ also, inadvisability of increasing the proportion of groundnut in the vegetable milk powder, possibility of improving the nutritive value by fortifying with synthetic amino acids, etc.

Winding up the discussion, the President said that the subject was one of great importance. It was necessary to have a right composition of the material, particularly to suit roller-drying. He stressed the need for educating people about the importance of growing more and more of soyabean. It is necessary to carry out feeding trials with infants and weaning children to establish the usefulness of the product. We should aim at getting a product of higher P.E.R. and overall nutritive value, possibly even better than cow's milk. The vegetable milk powder may have a better role in feeding infants to overcome liver disorders, widely prevalent particularly in South India. The fact that vegetable milk forms a loose curd in the stomach may help easy digestion as otherwise found with animal milk. In conclusion, he referred to the resultant nutty odour as the main obstacle in increasing the proportion of the groundnut component in the milk blend but, however, felt that this prejudice should be overcome.

S (IS) 13

Groundnut protein isolate and its nutritional improvement, by N. Subramanian (April 22, 1960). —Introducing the subject, the speaker said that the importance of the work on protein isolates has increased in recent years mainly due to the technological progress in this field in the U.K., U.S.A. and in our country. The only major source of raw material available in India at present for the production of edible proteins is groundnut. The isolated protein is superior to the cake in protein content and flavour; it is free from fibre and other indigestible carbohydrates and can be used with advantage for preparing protein-rich processed

The speaker reviewed the earlier work done in the Institute on the isolation of groundnut protein from cake and the kernel, and described briefly the details of the process adopted for the pilot plant trials. The method of obtaining protein from the kernel or the cake is similar though the process conditions vary. The cake protein isolate has a residual oil content of 1-2 per cent while that from the kernel has an oil content varying from 4-8 per cent. The isolates had a nitrogen content varying from 15.5-16.5 per cent on moisture, fat and ash free basis. The integrated processing of the groundnut is likely to be more economical for the production of protein.

Mr. Subramanian then discussed the nutritional aspects of the isolate. He drew attention to the variation in the values for amino acid content of the protein and pointed out that on the basis of the currently accepted values, the major deficiencies are methionine and lysine. The protein is also deficient in respect of isoleucine, valine, threonine, tryptophan and leucine as compared to the whole egg proteins. The speaker said that while a large number of studies have been carried out on the proteins of the whole meal or the isolated arachin or conarachin fractions of groundnut, data on the total protein isolate are meagre. It was against this background that detailed studies on the nutritive value of the isolate from edible quality cake were carried out.

The first series of growth and nitrogen balance studies carried out on rats at 10 per cent level of protein indicated that (1) the digestibility co-efficient of the isolate is higher than that of the whole cake while the biological value is slightly

lower; (2) the protein isolates obtained from the kernel and the cake do not differ in their nutritive value; (3) the protein efficiency ratio of the cake is improved to a greater extent compared to the isolate on supplementation with *dl*-methionine and (4) there is no true supplementary effect between casein and groundnut protein when fed in equal proportion in the diet.

In the second set of experiments, groundnut protein isolate supplemented with 2.1 per cent *dl*-methionine and 1.7 per cent *l*-lysine gave a growth response and nitrogen retention comparable to an equal mixture of casein and groundnut protein. The blend of casein and groundnut protein on further supplementation with methionine and lysine gave the maximum growth response as well as nitrogen retention. It was also seen that when the protein was fed at 20 per cent level it is poorly utilised even though the growth is stimulated to a great extent. When the gains in weight were plotted against nitrogen intake from the respective diets, the differences in the quality of the proteins were brought out in a striking manner. For an initial gain in weight of 50g. for weanling rats, the amount of nitrogen required in the case of casein was 2.75g., while in the case of groundnut protein it was about 5.8g. On supplementation of the protein isolate with methionine and lysine, the animals required about 3.75g. nitrogen.

In the last series of experiments, the mutual supplementary effect between groundnut protein isolate and other vegetable protein isolates from soyabean, sesame and Bengalgram were studied. When groundnut protein constituted 50 per cent in any of the blends, the protein efficiency ratio ranged from 1.5-1.7.

The protein quality of these blends were enhanced considerably by judicious blending with casein and amino acids.

The speaker stressed the importance of supplementing the isolate with amino acids or good quality proteins to improve its nutritive value.

During the discussion, questions relating to the requirement of amino acids, optimum levels of supplementation, variations in the overall growth of rats at different periods in the year, colour of the protein, use of fish flour for supplementation and the extent of improvement in protein quality obtainable by adding all limiting factors, etc., were answered.

The President, in his concluding remarks, said that the quantity as well as quality of the protein consumed in India was quite low. Groundnut protein has a poor pattern of essential amino acids and hence the need for improving the nutritional value of the protein. He stated that fermentation of blends of proteins might improve the protein efficiency ratio. By judicious blending of vegetable proteins, we can approach very near to the nutritive value of some animal proteins. Groundnut offers itself to easy processing as compared to other oilseeds. But the other oilseeds could also be properly processed so that the proteins isolated from them could be blended and used. Supplementation of the proteins with amino acids has been shown to be useful but some method should be evolved to make the added amino acids stable. He concluded by saying that the protein industry had now come to stay and there was scope for a variety of uses for isolated proteins.

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Utilization of ginger

E (IS) 37

There are enough ginger available in our area. Would you please inform us the methods of utilizing them on commercial scale? (Cachar District).

The products that can be manufactured from ginger are:

(1) Ginger preserve and candy
(2) Ginger pickles (3) Non-alcoholic beverages like ginger cocktail
(4) Dehydrated ginger (5) Oil of oleoresin from ginger for purposes of flavour and for use in pharmaceutical preparations, etc.

Good quality fibreless tender ginger is used for the preparation of high quality ginger preserve and candied ginger. Shavings out of the manufacture of ginger candy and preserve are used for the manufacture of ginger pickles. Non-alcoholic beverages just like squashes may be made from ginger and other citrus juices and these beverages are becoming very popular these days both in the form of squashes or nectars and in the form of ready-to-serve beverages. Ginger can also be dried in the form of ginger powder and by dehydration at controlled temperature and humidity better quality product is obtained. From the peelings, shavings and poor quality ginger, oleoresin and oil of ginger can be extracted by the solvent extraction method. Both the oleoresin and volatile oil of ginger find use in many food processing and pharmaceutical industries.

Cocoa nut milk curd

E (IS) 38

I have tried to prepare curd from cocoa nut milk but find that it does

not set well. Can you kindly explain to me the correct formula for preparing the same? (Chittor District).

In this Institute, we did some work on the preparation of a milk substitute from cocoanut and thereafter converting it into curd as usual. Though the curd obtained has a creamy layer like natural curd, it does not set well because of the low protein content. Fairly good milk and curd could, however, be obtained by blending protein concentrates like skim milk powder, groundnuts or soyabeans, to the extent of 25-50 per cent. By adding these, the protein content of the resulting milk emulsion is increased and as such, on fermentation it yields a well set curd. Addition of skim milk powder also improves the flavour of cocoanut milk.

Composition and uses of cluster beans

E (IS) 39

We have guar seeds in abundance in our area and we are thinking of exporting the same to the United States of America where there is a good market for it. We shall feel obliged if you kindly inform us the composition of this material and also its probable uses. (Rajapura, Punjab).

The guar seed is known in English as cluster beans having the botanical name *Cyamopsis tetragonoloba*. The fresh beans have the following composition:

Moisture	... 82.5%
Protein	... 3.7%
Fat (ether extraction)	... 0.2%
Mineral matter%	... 1.4%
Fibre	... 2.3%
Carbohydrate	... 9.9%
Calcium (Ca)	... 0.13%
Phosphorus (P)	... 0.05%

Iron (Fe)	... 5.8%
Calorific value per 100 g.	... 56
Carotene (International vitamin A Units per 100 g.)	... 330
Vitamin C (mg. per 100 g.)	... 49

Guar seed is generally used as an adhesive, stabiliser and also in medicinal preparations. It has laxative action, improves appetite and is helpful in curing night blindness as it is a good source of vitamin A. We do not know exactly for what purpose it is used in the United States but we presume that it is used mostly as a stabiliser.

Cream for sandwiching biscuits

E (IS) 40

Please be kind enough to send me some formulae for manufacturing cream for sandwiching biscuits. (Indore).

The formulae for preparing cream meant for sandwiching biscuits are given below:

Formula No. 1

Unsalted margarine	... 14 lb.
Icing sugar	... 17 lb.
Ice cream powder (cold)	... 2 lb.
Honey	... 2 lb.
Boiled meringue (cold)	... 3 lb.
Glycerine	... 8 oz.

Place the materials in machine in the order as given; have the machine at slow speed, give a thorough mix, then beat at top speed till the mixture is nice and light. Divide into several dishes, add colours and flavours and pipe on to the biscuits. To get the best results, this filling should be used right away as it sets fairly firm in a very short period and can withstand a considerable amount of heat during hot weather.

Formula No. 2

(Butter cream)

Unsalted butter	...	8 lb.
Icing sugar	...	8 lb.
Glycerine	...	4 oz.
Made-up meringue	...	1 lb.

Formula No. 3

(Butter cream marzipan)

Unsalted butter	...	1 lb.
Icing sugar	...	8 oz.
Fondant	...	12 oz.
Marzipan	...	8 oz.
Made-up meringue	...	8 oz.
Vanilla	...	

With the exception of the meringue, cream all together adding the meringue at the final stage. This is a top-grade cream.

The cold meringue referred to above in the recipes, is made from the following:

Whites or albumin	...	1 pint
Cream of tartar	...	$\frac{1}{4}$ oz.
Sugar	...	3- $\frac{1}{2}$ lb.

Beat the whites in the machine and when fairly stiff, add the tartar, then the sugar gradually, till it is all used. Continue to beat till a firm meringue is acquired.

Marzipan which is also used in formula No. 3 is made from 2/3 almonds and 1/3 sugar and in such a paste the whole of the natural flavour and oil are retained. The blanched almonds for marzipan are not dried. They are passed through a careful process of roasting; the almond oil is freed and runs evenly throughout the paste. Thus the delicate flavour is fully retained and enhanced by the roasting process. It is preferable to use marzipan instead of ground almonds for all almond paste goods.

Curing and processing of tur dhal

E (IS) 41

I shall be grateful if you can kindly furnish me details regarding the curing and processing of tur dhal. Also give the composition of the dhal and the addresses of the firms in India that supply the tur dhal hulling and polishing machines. (Peradeniya, Ceylon).

We are giving below the composition of the red gram (*Cajanus cajan*).

Moisture	...	15.2%
Protein	...	22.3%
Fat (ether extractives)	...	1.7%
Mineral matter	...	3.6%
Carbohydrate	...	57.2%
Calcium (Ca)	...	0.14%
Phosphorus (P)	...	0.26%
Iron (Fe) mg.	...	8.8%
Calorific value per 100 g.	...	333
Carotene (International vitamin A Units per 100 g.)	...	220
Vitamin B ₁ (μ g. per 100 g.)	...	450
Nicotinic acid (mg. per 100 g.)	...	2.4
Riboflavin (μ g. per 100 g.)	...	506

The seeds are split into *dhal* before marketing. Milling is done in power mills, hand mills or *chakkis*. There are two main processes of making *dhal*, the dry and the wet, each differing somewhat in details is different parts of the country. In the dry method, the seeds are exposed to the sun for 3-4 days and then split in a mill. The seeds are sometimes smeared with a small quantity of vegetable oil (gingelly or castor oil) to soften the seed coats and facilitate the milling. The unsplit seeds are removed, treated with oil, dried in the sun and milled again when a further portion is split and dehusked. This fractional milling is repeated three or four times till all the seeds are split into halves. By this method, 100 pounds of seeds yield about 66 lb. of clean *dhal*, the rest being broken fragments and seed coats. In the wet method, the seeds are first soaked in water for 6-10 hours. They are then mixed with sieved red earth (5 lb. per 100 lb. of seeds), heaped up and left over night. The seeds are spread out and dried in the sun, sieved and winnowed to remove the earth, and finally split into *dhal* in a hand mill. 100 lb. of seeds so treated yield 80 lb. of *dhal*, the percentage of broken seeds being considerably less than in the dry method. The object of the pre-milling treatment is to swell the seed coats and facilitate their separation during milling. The third method of *dhal* preparation consists in half-roasting the grain followed by

splitting in the usual way. The dry method is somewhat costlier than the wet method since the amount of broken *dhal* is comparatively high and the milling has to be effected in three or four turns. The *dhal* obtained by the dry method is hemispherical in shape, softens rapidly on cooking and gives a good flavour and, therefore, fetches a better price in the market. *Dhal* prepared by the wet method is usually flat, has small depression in the centre due to shrinkage and softens slowly during cooking. The split *dhal* is cleaned by repeated winnowing and sieving and treated with castor or gingelly oil (about 2 $\frac{1}{2}$ lb. per 100 lb. of *dhal*) to preserve its quality, prevent insect attack and give it an attractive appearance.

Dhal obtained from cultivated crops in black cotton soils has better cooking qualities because of the presence of considerable lime in the soil. The quality of water used in *dhal*-making is also stated to influence its quality. Water, poor in calcium, magnesium and sodium salts is supposed to add to the cooking quality of the *dhal*.

Dhal is extensively used as a protein adjunct to an otherwise starchy diet. It is consumed in various ways, the most common being cooking with spices and vegetables. Raw seeds taken in quantity are said to produce a soporific effect. Greenpods are used as vegetable. The husk of pods and seeds obtained during threshing constitutes a valuable cattle feed. Mixed with broken bits of *dhal*, the husk is sold under the name '*Chunni*' for feeding milch cattle. The green leaves and tops of the plant are used as fodder. They are also used as green manure. The dried stalks obtained after threshing are used for fuel or for thatching.

As regards hulling and polishing, machines, you may contact the following firms:

- (1) Messrs. Behere's Industrial Engineering, Madras.
- (2) Messrs. Swaminathan Foundry, Madras.

- (3) Messrs. Vivekananda Industrial Engineers, Madras.
- (4) Messrs. Ghodke Borthers, Hubli.
- (5) Messrs. Bharat Mechanical Works, Ltd., Buckingham-pet P.O., Vijayawada.
- (6) Messrs. G. G. Dandekar Machine Works, Ltd., Bhiwandi.
- (7) Messrs. Kirloskar Ltd., Harihar, Mysore State.

Use of hellac in confectionery

E (IS) 42

We have received a communication from the Society of German Sweets and Chocolate Manufacturers, Bonn enquiring whether shellac, pure or arsinated, is harmful for stomach, if used as a coating on sweets and chocolates. As far as we know, arsinated shellac is harmful but not the pure one. Would you kindly throw some light on the subject? (Ranchi).

Edible shellac can be used as a glazing agent for sweets and chocolate manufacture. As per the federal food, drug and cosmetics Act of U.S.A., confectionery may contain harmless resinous glaze (shellac) not in excess of four-tenths of one per centum. Shellac used in confectionery is classed as harmless resinous glaze provided it is free from poisonous or deleterious impurities. We have not done any work on the subject and so will not be in a position to say anything about its effect on the stomach if it is used as coating on sweet and chocolate. This subject also does not fall within the purview of our work. Since you are interested in the physiological effect of the shellac on the human body, it is best for you to contact the Central Drug Research Institute, Lucknow, who might be able to do the needful in the matter.

Nickel content of vegetable foods

E (IS) 43

I shall appreciate very much if you can kindly furnish me data on the nickel content of vegetable foodstuffs. (New Delhi).

We have not done any work on the estimation of nickel in various foodstuffs. We have gone through the literature wherein some stray foreign references have been made regarding the nickel content of foodstuffs. Nickel has been reported in vegetable foods ranging from 4.6 p.p.m. of the dry matter of squash to 0.13 p.p.m. of that of water cress. Similarly, a number of fruits, vegetables and plant materials examined have been reported to contain nickel and cobalt, though the quantities are very small. The edible chanterelle (*Cantharellus cibarius*) gave the largest figure of 3.5 mg. of nickel per kilogram of dry substance. The nickel content of green leaves has been found to vary from 0.2 to 1.6 p.p.m. Except for these details we could not come across any more. We hope this would be of some use to you. Further, we wish to suggest that the Central Food Laboratory at Calcutta may be in a position to throw more light on the subject.

Nutritive value of rice

E (IS) 44

We shall be obliged if you will kindly supply us with the information regarding the nutritive value of hand-pounded rice as compared to polished rice. (Poona).

The nutritive value and the vitamin content of hand-pounded rice as compared to polished rice and dehusked rice are given in the following table:

	Dehusked rice %	Hand-pounded rice %	Polished rice %
Protein (g.) ...	7.7	7.2	6.9
Calcium (mg.) ...	15	13	10
Phosphorus (mg.) ...	368	146	107
Iron (mg.) ...	4.0	2.2	2.0
Thiamine (μg.) ...	360	190	105
Nicotinic acid (mg.) ...	3.5	2.2	1.0

It is evident from the above figures that hand-pounded or undermilled rice, is, from the nutritional point of view, superior to the polished rice. Although dehusked rice has a much better composition than even hand-pounded rice, it has poor culinary and storage qualities and becomes rancid in a short time. In the case of polished rice, the greater the degree of polishing, the higher is the loss of nutrients. As such, hand-pounded or undermilled rice can be considered a *via media* stage of polishing.

Composition of rice bran

E (IS) 45

Would you please write to me the composition of rice bran and the uses of the oil obtained from it? (Poona).

As regards the composition of the bran, it varies depending upon the degree of polishing given to the rice. The range of figures is given below:

Water ...	8.9—12.5%
Protein ...	10.6—13.4%
Nitrogen free extract ...	38.7—44.3%
Fat ...	10.1—22.4%
Fibre ...	9.1—14.1%
Ash ...	9.3—14.3%
Pentosans ...	9.7—11.4%
B-vitamins ...	—544 μg/g.

The bran contains 10-22 per cent of fat and is abundantly available in our country. A method has been developed at our Institute to extract the oil from the bran using the indigenous solvent, alcohol. The rice bran oil can be used without being refined as a cooking medium. It can be refined, bleached and deodorised to yield a salad oil which may be exported to other countries. It keeps well for a long time due to its high content of vitamin E and is much better than ordinary vegetable oils. The oil can also be used for the manufacture of hydrogenated fat and soaps. High-acid rice oil is suitable for use as a fat liquor in the leather industry.

Notes and News

STATISTICAL NOTES

All-India Final Estimate for the year 1959-60.

Crop	Area (hundred acres)		Production (hundred tons)	
	1959-60 Final estimate	1958-59 Partially revised estimate	1959-60 Final estimate	1958-59 Partially revised estimate
Ragi ...	62,110	61,920	18,600	18,770
Bajra ...	2,66,990	2,79,990	34,840	37,890
Dry ginger ...	370	357	134	123
Black pepper ...	2,320	2,301	254	255

*(Economic and Statistical Adviser, Ministry of Food & Agriculture,
Government of India)*

NEWS BRIEFS

Simplified manufacture of bread: The conventional procedure for making bread has been modified by increasing the speed (in a two bladed mixer) two to threefold, and by the immediate transfer of the dough from the mixer to the making up machinery, in which the rollers are set as closely as possible.

The composition of the dough needs no modification except for the addition of 1-2 per cent sugar. The quality of the resulting bread is described as being in no way inferior to the quality of ordinary bread (*Food Manuf.*, December 1959, p. 485).

Reconstitution qualities of dried milk: The extent to which dried milk sinks in still water is correlated with the ease of reconstitution. Improved sinking and dispersibility were observed when concentrated to 35 per cent solids and gassed before drying, causing it to foam during drying and dry into thinner films. Further improvement was obtained by heating the dried milk to a temperature above that at which milk fat melts, holding for a short time and cooling rapidly.

The dispersibility of the milk was also enhanced by rapid cooling of the dried milk after it came from the dryer and by not allowing the particles to rub against each other or other objects during chilling. Improved dispersibility obtained by these means is attributed to the arrangement of the free fat on the surface of the particles.

The qualities are retained for 6 months at a temperature of 6°F., but is lost more rapidly with temperature increases until at 32°F. it disappears within 4 hr. Dried whole milk, it was concluded, should be stored and marketed under refrigeration (*Food Manuf.*, December 1959, p. 485).

Liquid CO₂ refrigeration: A new process may mean that perishable foodstuffs, such as fish, meat and game, can be delivered from the Highlands to London and the south in a much fresher condition than has been possible hitherto. The Distillers Company Ltd., British Railways, and a frozen foods company have co-operated in an experiment with the new method, perfected by D.C.L., which employs liquid carbon dioxide. This is a variant of dry ice, which has been used as a preservative until

now. It is claimed that the new process is 100% more efficient.

The demonstration was arranged at the premises of Moray Firth Foods, Ltd., Bunchrew, near Inverness. A consignment of scampi was loaded on a B.R. container for transport to the West Kent cold store, where they will be kept for distribution to wholesalers in the London area. The scampi were sprayed with liquid carbon dioxide from a road tanker sent north by D. C. L.

Within seconds their temperature was reduced to -5°F., as compared with 15°F. under the old method. It was stated that the scampi would keep indefinitely at this temperature with ordinary refrigeration (*Food Manuf.*, December 1959, p. 490).

Phytic acid treatments for pre-peeled potatoes: Pre-peeled potatoes dipped for 1 min. in 0.7 per cent solution of phytic acid or 0.5 per cent calcium phytate and 1000 ppm sulphur dioxide and packed in polyethylene bags were not discoloured after 16 days' storage at 40-42°F. Potato chips treated with 1.4 per cent phytic acid plus 1000 ppm sulphur dioxide, 1.0 per cent calcium phytate plus 1000 ppm sulphur dioxide and 2000 ppm sulphur dioxide alone received lower scores from 10 judges who could identify the standard fresh sample when cooked and mashed. Ten other judges could not distinguish between the treated and untreated samples (*Food Technol. Austr.*, December 1959, p. 682).

What constitutes flavour of canned peas?: A project is under way at the Research Laboratories of The National Canners Association to determine the chemical substances in peas responsible for flavour. The work is being done by a member of the N.C.A. staff working with a U.S. Department of Agriculture group specializing in flavour research.

So far, a number of substances apparently related to pea flavour have been isolated and the amounts

determined. Steam distillation separates out the principal substances responsible for the odour of peas. Although ammonia constitutes a considerable portion of this material, the subtle flavour overtone, are produced by minute amounts of carbonyl compounds which are presently being isolated by means of gas chromatography. Of the non-volatile substances associated with flavour, the sodium salt of glutamic acid, the sugar, sucrose and acetoin seem to be important.

Once these flavouring components are known, efforts can be made to improve flavour by seeking varieties of peas containing a proper balance of these constituents and by studying technological means of enhancing or preserving them (*Food Technol. Austr.*, December 1959, p. 682).

Storage of peeled potatoes: The Low Temperature Research Station (Cambridge, England) has recently investigated the optimum amount of sulphite to be added to pre-peeled potatoes, to prevent oxidative deterioration and yet to permit the thiamine content to be unaffected. The optimum conditions were found to be treatment of the peeled tubers with 0.5 per cent sodium metabisulphite at pH 6.0 and storage at 3°C. Under these conditions, a storage life of 12-14 days is possible. Other browning inhibitors are being investigated (*Food Technol. Austr.*, December 1959, p. 682).

Effect of in-package desiccation on the storage properties of compressed and uncompressed dehydrated cabbage: E. G. B. Gooding and R. B. Duckworth of the Ministry of Agriculture, Aberdeen, Scotland have studied the effects of in-package desiccation on dehydrated, compressed and uncompressed cabbage stored at 99°F. The rate and extent of water loss from compressed cabbage was somewhat less than from uncompressed cabbage, but the rate of deterioration of the two appeared to be generally similar. Desiccation reduced the rate of deteriora-

tion of flavour, texture and colour and inhibited destruction of ascorbic acid.

A 3 to 4 fold increase in shelf-life required the sacrifice of about 5 per cent of the space to desiccant (calcium oxide) in the case of uncompressed cabbage and about 20 per cent for compressed cabbage (*Food Technol. Austr.*, December 1959, p. 694).

Liquid grain fumigant: Frontier Chemical has developed a liquid grain fumigant to be sold under the trademark Clorofume.

According to Frontier, testing of the new fumigant has demonstrated the following important advantages: high insect toxicity (killing at half the normal dosage); greater grain penetrating power; savings of 20 to 30 per cent per bushel of protected grain; safe handling (requires no special equipment or extraordinary precautions and has been rated fire and explosive safe by insurance firms); and absence of health hazard to human life when used with reasonable care. It is approved by FDA and USDA without restrictive use recommendations or residual tolerance limits.

Clorofume is composed of chloroform, carbon bisulfide, and ethylene dibromide, which form a mixture much more effective than the individual chemicals by themselves (*J. agric. Fd. Chem.*, December 1959, p. 863).

Import of food processing machinery from Yugoslavia: Yugoslavia manufactures food processing machinery like roller flour mills, fruit and vegetable preservation machinery including plant and equipment for the manufacture of tomato paste, etc. Indian manufacturers who are interested in such machinery may approach 'INGRA', who are manufacturers of power and industrial plants C/o 17 Link Road, Jungpura Extension, New Delhi-14.

Import of food processing machinery under U.S. Export-Import Bank Loan Programme: The Export-Import Bank of U.S.A.

have agreed to finance import of equipment for food processing and canning factories. Processed Food Manufacturers in India are invited to take advantage of this scheme and applications in respect of fish and fish products may be submitted to the Fisheries Development Adviser, Government of India, Ministry of Food and Agriculture, 'Krishi Bhavan', New Delhi and in respect of other food processing industries to the Secretary, Development Council for Food Processing Industries, Ministry of Commerce and Industry (Development Wing), New Delhi. Further details regarding the scheme to import machinery under U.S. Export-Import Bank loan may be obtained from the Joint Chief Controller of Imports and Exports at different ports.

ISI Certification mark for biscuits: The Indian Standards Institution has recently granted licences to 7 manufacturers of biscuits authorizing them to apply the ISI Certification mark on the containers of biscuits which conform to the Indian Standard Specification for Biscuits (IS: 1011-11957).

The ISI Certification mark ensures that the biscuits are crisp, well-baked, free from grit and adulterants and that they do not contain anything injurious to health. It also ensures that the raw materials used in the manufacture of biscuits are of good quality, and conform to prescribed standards.

DRAFT INDIAN STANDARDS

Tapioca starch for use in textile industry: The draft Indian Standard Specification for Tapioca Starch prescribes requirements and methods of test for various characteristics of tapioca starch for use in the cotton textile industry as a sizing and finishing material.

Tapioca starch is manufactured from the tuberous roots of the tapioca plant both on the cottage industry basis and on the factory scale. It is expected that a standard specification for tapioca starch would be of use to producers in preparing

tapioca starch of acceptable quality and to purchasers in acquiring dependable supplies (*ISI Bull.*, November/December 1959, p. 274).

Essential oils: Two more items of essential oils have been covered by the draft Indian Standard Specifications for:

1. *Indian Dil oil*
2. *Patchouli oil*.

Dil oil is chiefly used as a flavouring agent for food industries, and to some extent in perfumery and pharmaceutical industries.

Patchouli oil is used in oriental type of perfumes because of its high perfume fixative quality, and is also used in the manufacture of soaps, cosmetics and incense.

Both these draft specifications lay down requirements and methods of test along with details of sampling, marking and packing, and form part of the series of Indian Standards on essential oils, covering twelve specifications for various items and the Methods of Test for Essential Oils (*ISI Bull.*, November–December 1959, p. 275).

Infant milk food: Infant foods, at present in use in the country, have so far been imported. They can be divided into three categories, namely (a) infant milk foods, (b) infant foods without milk, and (c) specialized foods. Efforts are now being made to manufacture them in the country, and some manufacturing units are being set up.

The value of an infant food depends upon its stimulation of, or suitability as a complete or partial substitute for human milk. This, in turn, depends on its contents of protein, fat, carbohydrates, minerals, vitamins and the supply of calories.

The draft Indian Standard Specification for Infant Milk Food prescribes requirements and methods of test in respect of total protein, fat, total carbohydrates, total ash, vitamins, iron, bacterial estimate, solubility index, etc., and also details of sampling, packing and marking (*ISI Bull.*, November–December 1959, p. 276).

FOREIGN PATENTS

2,895,836. Unsulphured dehydrated fruits: Produced by dipping in saltcitric acid solution, drying below 110°–135°F, blanching, and dehydrating below 10 per cent moisture.—Patented by M. E. Lazar (*Food Engng.*, December 1959, p. 137).

820,995. Fat composition: A process for the preparation of a solid free-flowing oil or fat-containing composition, comprises forming an emulsion of an edible oil or fat in an aqueous medium at a pH of from about 8.0 to about 10.0 in the presence of milk protein and drying the emulsion to form a solid.—Patented by Unilever Ltd. (*Food Trade Rev.*, December 1959, p. 48).

821,761. Cereals: Relates to the production of a pre-cooked granular or floury product by puffing maize, wheat, rice, oat, etc., cereal grains followed by a milling operation: it obviates expensive operations such as milling the grains before cooking—a cooking stage other than is obtainable by the puffing, and further milling of the cooked grains with one or more dehydrating stages: the product can be used directly by mixing into a paste, cream or porridge with either hot or cold milk, or incorporated in the manufacture of 'instant' puddings, bread and pastry.—Patented by Fritz Grossman (*Food Trade Rev.*, December 1959, p. 48).

821,371. Shell-less eggs: Relates to a method and means whereby an egg may be removed from its shell and packaged in a plastic container in an attractive manner with consumer appeal while retaining its full flavour: the object is to enable an egg to be marketable at a higher price than it would fetch under normal marketing methods according to which it would be under-graded because of defects such as being cracked, mis-shapen, stained or thin-shelled, which do not in any way affect the nutritional value of the egg but nevertheless prevent it fetching the price of Grade A eggs.—Patented by Lawrence B. Darrah (*Food Trade Rev.*, December 1959, p. 48).

821,006. Cartons: Relates to a carton of unitary or one piece construction which can readily be folded and erected from its original flat condition to form a six-sided carton, with a transparent top wall forming an integral part of the original unitary carton blank, thus eliminating the necessity for a separate operation to apply an overwrapping of cellulose film or similar material about the erected carton.—Patented by Continental Paper Co. (*Food Trade Rev.*, December 1959, p. 50).

821,369. Preserving fish: Freshly caught fish is preserved on board trawlers by subjecting it to a high vacuum in a tank for degassing and venting with a vacuum such that the evaporation of the liquid on the surface of the fish results in a cooling down to freezing temperatures without freezing the fish, and the latter maintained in their degasified and vented condition so as to suppress bacteriological and autolytic decomposition.—Patented by Hans Beckmann (*Food Trade Rev.*, December 1959, p. 50).

Information from Foreign Journals

THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

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Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

The effect of feeding of diets containing *Lathyrus sativus* seeds on the body composition and certain enzymes of liver of albino rats, by Seetha Ganapathy, N., Sreenivasamurthy, V., Swaminathan, M. and Subrahmanyam, V., *Ann. Biochem. exptl. Med.*, 1959, 19 (9), 231.—Groups of young rats were fed on diets based on (1) 50 per cent wheat + 50 per cent *Lathyrus sativus*, (2) *Lathyrus sativus* seeds alone and (3) *L. sativus* seeds supplemented with 0.2 per cent β -amino-propionitrile (BAPN). Rats receiving wheat and *Lathyrus* diets (with or without wheat) excreted appreciable amounts of thiocyanate in the urine. The differences between the two groups in respect of their ability to acetylate PABA were not statistically significant. Addition of BAPN to the diet caused a marked increase in the excretion of thiocyanate in the urine and a decrease in the acetylation of PABA. Similarly no significant difference could be observed between the two groups fed on wheat cum *Lathyrus* and *Lathyrus* diets in respect to body composition and bone ash. The difference in the dehydrogenase activities of the liver between the two groups was, however, significant at 1 per cent level. Addition of β -aminopropionitrile, the toxic factor present in *L. odoratus*, to the diet based on *Lathyrus* seeds caused changes in the bone and decreased the bone ash content, the dehydrogenase activities of the liver and the body-fat content.

Improvement in Golgi's dichromate silver impregnation method, by Jayaraj, A. P. Bhagavan, R. K., and Swaminathan M., *Indian J. Path. & Bact.*, 1959, 2 (3) 218.—An improved

procedure for obtaining consistent clear dichromate-silver staining (Golgi reaction) of nervous tissues is described. Use of tap water instead of distilled water in the preparation of the chromating fluid and silver nitrate solution leads to consistently successful Golgi reaction. Studies with distilled water containing different salts commonly occurring in tap water, indicate that distilled water containing magnesium sulphate (910 parts) and sodium sulphate (5 parts) per 100,000 parts has the same beneficial effects as tap water in obtaining a consistently clear dichromate-silver staining of the tissues.

Studies on the stability of winterized cottonseed oil, by Krishnamurthy, K., Swaminathan, M., Bhatia, D.S. and Subrahmanyam, V., *Proc. Symp. on Cottonseed and its products*, 1958, 82.—The physical and chemical constants of winterized cottonseed oil as well as those of the original refined and bleached oil have been determined. The autoxidative stability of cottonseed oil is not materially affected on winterization. Propyl and dodecyl gallates along with citric acid as a synergist are effective in retarding the development of peroxides.

Studies on milk substitutes of vegetable origin. Part I. The nutritive value of milk substitutes prepared from soyabean and groundnut, by Shurpalekar, S.R., Lahiry, N.L., Chandrasekhara, M.R., Swaminathan M., Indiramma, K. and Subrahmanyam, V., *Ann. Biochem. exptl. Med.*, 1959, 19 (11) 269.—Experiments on albino rats showed that soyabean milk, groundnut milk and their blends (containing 2.5 per cent protein and fortified

with calcium and vitamins) promoted fairly good growth (10-11 g. per week) as compared with that (15.7 g.) obtained with modified reconstituted cow's milk containing 2.5 per cent protein. A mixture of 4 parts of vegetable milk blend and one part of modified reconstituted cow's milk promoted significantly higher growth (13.8 g.) than the vegetable milk blend alone. The PER of the proteins (at 10 per cent level) of spray-dried vegetable milk powder (from blend of 2 parts of soyabean milk and one part of groundnut milk) and of skim milk powder were 1.93 and 3.21 (4-week period) and 1.68 and 2.28 (8-week period) respectively. The PER of the proteins of a mixture of 4 parts of vegetable milk powder and one part of skim milk powder were 2.49 and 2.02 respectively in the same periods.

Utilization of buffaloes' milk for the production of infant food, by Chandrasekhara, M. R., Narayana Rao, M., Swaminathan, M., Bhatia, D. S. and Subrahmanyam, V., *Proc. XV Internat. Dairy Cong.*, 1959, 2, 1147.—Buffalo milk has not so far been used for the preparation of infant foods in any country. In view of the fact that only buffalo milk is available in surplus quantities in certain parts of India, investigations were undertaken to standardize methods of preparation of infant foods from buffalo milk. Infant food having a low curd tension, good solubility and palatability and low bacterial count has been prepared from buffalo milk collected in a dairy. The shelf life of infant food prepared from buffalo milk using spray and roller driers and packed in air and in nitrogen has been studied. Spray-dried infant food prepared from

milk collected in aluminium vessels and packed under nitrogen had a shelf life of 8 months at 37°C and about 16 months at 27°C. Contamination of fluid milk with copper caused by keeping the milk in brass vessels affected adversely the shelf life of the infant food. Roller-dried infant food when packed in tins in air had a shelf life of about 1 year. Large-scale production of infant food from buffalo milk was carried out using commercial model spray and roller driers. Feeding experiments with the above food on infants showed that the food was easily digestible and promoted satisfactory growth in infants.

The effect of supplementary processed protein foods fortified with essential vitamins and minerals on the growth and nutritional status of undernourished weaned infants, by Subrahmanyam, V., Doraiswamy, T. R., Bhagavan, R. K., Narayana Rao, M., Sankaran, A. N. and Swaminathan, M., *Indian J. Ped.*, 1959, 26 (142) 406.—A feeding experiment extending over a period of nine months was conducted on fifty-four weaned infants ranging in age from nine to twenty months to assess the value of supplementing their diets with a balanced malt food (composed of *jowar* malt, low fat groundnut flour, Bengalgram flour and skim-milk powder) and protein food of low cost (based on low fat groundnut flour, Bengalgram flour and skim milk powder)

fortified with certain vitamins and calcium phosphate.

On the basis of the initial height, weight, haemoglobin content of blood and nutritional status, the infants were allotted into three groups so that each group consisted of ten girls and eight boys. The values for the weight, height, nutritional status and haemoglobin content of blood were obtained at the beginning and end of the experiment for the experimental and control groups. The increases in the height, weight and haemoglobin level of the infants receiving the malt food and protein food of low cost respectively were significantly greater than those observed in infants in the control group receiving a supplement of rice. Eighty per cent of the infants in the two experimental groups improved in their nutritional status, whereas none in the control group showed improvement. On the other hand, three children in the control group showed deterioration in the nutritional status.

Nutritive value of crude, refined and hydrogenated cottonseed oil, by Narayana Rao, M., Kuppaswamy, S., Swaminathan, M., Bhatia, D. S. and Subrahmanyam, V., *Proc. Symp. on Cottonseed and its products*, 1958, 279.—No significant difference was observed between the growth promoting value of diets containing 10 per cent of crude, refined and hydrogenated cottonseed oil, refined groundnut oil and cow's *ghee*. Crude, refined and hydrogenated

cottonseed oils were found to be digestible to the extent of 95-98 per cent in the rat. About 70-75 per cent of calcium and 65-70 per cent of phosphorus was utilized in the case of rats fed on diets containing 10 per cent of crude, refined and hydrogenated cotton seed oils.

Supplementary value of low-fat cottonseed flour to poor vegetarian diets based on certain cereals, by Krishnamurthy, K., Pantulu A. J., Narayana Rao, M., Swaminathan, M., Raghunatha Rao, Y. K. and Subrahmanyam, V., *Proc. Symp. on Cottonseed and its products*, 1958, 246.—The supplementary value of alcohol-extracted cottonseed flour to poor vegetarian diets based on wheat, *ragi*, rice and *jowar* was determined by the rat growth method. The results showed that when incorporated at 10 per cent level in the diet, cottonseed flour has a marked supplementary value to diets based on *ragi* and *jowar* and only a moderate supplementary value to rice and wheat diets. The protein efficiency ratio of the proteins of alcohol-extracted cottonseed flour (at 10 per cent level) was found to be slightly superior to those of expeller-pressed meal. The supplementary relation between the proteins of cottonseed flour, *jowar* and wheat was determined by the rat growth method. The results showed that the proteins of cottonseed flour supplemented to a marked extent the proteins of wheat and *jowar*.

PART II (Indian)

ADULTERATION

Application of paper chromatography to differentiate ghee from other fats. Part I. Behaviour of unsaponifiable matter on chromatograms, by Ramachandra, B. V. and Dastur, N. N., *Indian J. Dairy Sci.*, 1959, 12, 139.—A paper chromatographic method was standardised to differentiate *ghee* from *vanaspati* and body fats as well as from adulterated samples contain-

ing the latter. By spotting the unsaponifiable matter and observing the filter-paper under ultra-violet light after irrigation it was found that adulteration with 10 per cent *vanaspati* and 5 per cent of animal body fats could be detected easily and unambiguously.

BIOCHEMISTRY AND NUTRITION

Relation of dietary fat and cholesterol to tissue and serum

cholesterol and polyunsaturated fatty acids in rats, by Patil, V. S. and Magar, N. G., *Indian J. med. Res.*, 1959, 47 (4), 448.—Free cholesterol was slightly increased, and the accumulation of ester cholesterol, to a great extent, was present in all tissues and serum of cholesterol-fed rats. Phospholipids were markedly reduced in liver and significantly lowered in other tissues and serum. The ratio of cholesterol to phospholipids was increased in

the cholesterol fed groups. Decrease of dienoic, tetraenoic and increase of trienoic and little reduction in pentaenoic and hexaenoic acids were observed in cholesterol fed groups. Total fatty acids were increased in the same groups.

Liability of intramitochondrial component in experimental thyrotoxicosis and liver injury in the rat, by Kasbekar, D. K., Rege, D. V. and Sreenivasan, A., *Indian J. med. Res.*, 1959, 47 (4), 456.—Evidence of damage to mitochondrial integrity under the metabolic stress conditions of experimental hyperthyroidism and of liver injury and protection by vitamin B₁₂ against this impairment have been indicated from studies on (i) optical density, (ii) E₂₆₀ release, and (iii) magnesium levels in isolated mitochondria.

Renal function in nutritional oedema, by Srikanthia, S. G. and Gopalan, C., *Indian J. med. Res.*, 1959, 47 (4), 467.—Renal function in 5 cases of nutritional oedema was investigated by studying the inulin and diodone clearances. The inulin and diodone clearance values were found to lie within the normal range, thereby indicating normal renal plasma flow and glomerular filtration. The low urine minute volume in spite of normal clearances would appear to indicate increased tubular reabsorption.

Physiological effects of low-protein diets. Part I. Studies on nitrogen balance, growth, reproduction and lactation, and basal metabolism in rat, by Ambegaokar, S. D. and Chandran, K., *Indian J. med. Res.*, 47 (5), 359.—The effect of two low-protein rice diets on nitrogen balance, growth, reproduction and lactation, and basal metabolism was investigated in rats of three successive generations. The results are summarized as follows:

Retention of nitrogen in mg./100 cm²/day indicated the comparative state of nourishment of animals in the three groups.

Growth response on the 5 per cent protein diet (diet A) was

poor in all the three generations and that on the 8 per cent protein diet was sub-optimal in the first generation and was further lowered in the subsequent two generations.

Breeding tests showed that both the diets A and B were unable to maintain the normal levels of reproduction and lactation for animals. They decreased the litter size, the weight of youngs on birth, and the weight of weaned rats on 21st day. Mortality among the suckings was also high. However, animals on diet B were in more favourable position with respect to the performance of these physiological functions.

The levels of basal metabolism for rats receiving low-protein rice diets were significantly below normal and this effect of the diets on basal heat production was accentuated in the succeeding generations.

The significance of these findings has been discussed.

Physiological effects of low-protein diets. Part II. Studies on haemoglobin, erythrocytes, and plasma protein formation in rat, by Ambegaokar, S. D. and Chandran, K., *Indian J. med. Res.*, 1959, 47 (5), 552.—Two low protein-rice diets were investigated for haemoglobin and plasma protein formation in rats. The results are summarized as follows:

The average levels of haemoglobin, red cell count, and plasma protein for adult rats on normal diet C were found to be about 14.6 g. per cent, 7.68 millions/c.mm., and 6.02 g. per cent, respectively.

The low protein rice diets A and B produced anaemia and hypoproteinaemia in rats to different degrees in order of the levels of protein in the diets. The rats were comparatively more anaemic during growth period than during the latter part of the experiments, probably because they were unable to bear the physiological stress of growth.

The reduction in circulating haemoglobin and plasma protein per 100 cm.² to varying degrees in order of the levels of protein

in diets A and B was the manifestation of lower levels of blood volume, haemoglobin and plasma protein.

The decrease in blood volume per 100 cm.² to different levels for rats on diets A and B was the result of diminution in both plasma volume and packed cell volume.

The significant differences in means for plasma protein concentration between the three groups were solely due to alterations in electrophoretic albumin fraction.

The significance of these findings has been discussed.

Effect of dietary fats and cholesterol on the tissue and serum polyunsaturated fatty acids in rats, by Patil, V. S. and Magar, N. G., *Indian J. med. Res.*, 1959, 47 (5), 571.—The contents of linoleic and arachidonic acids were higher in heart, liver, serum and kidneys of rats fed on groundnut oil diet than those fed on coconut oil, *vanaspati* (Dalda) and *ghee* diets.

There was increase in total fatty acids and slight decrease in polyenoic fatty acids content in tissues and serum of control group animals as the age of the rat advanced from 24 weeks to 45 weeks. But when the feeding period of dietary fats plus cholesterol was increased from 13 weeks to 34 weeks in experimental animals, a marked reduction in tetraenoic, and a significant decrease in pentaenoic and hexaenoic acids were noted. Similar effect of cholesterol feeding for 13 weeks was observed in the rats aged 24 weeks.

Vitamin B₁₂ stores in the human body. Part I. Vitamin B₁₂ content of human serum in normal and some pathological conditions, by Jhala, C. I. and Gadgil, R. K., *Ann. Biochem. exptl. med.*, 1959, 19 (12), 287.—Serum vitamin B₁₂ has been estimated in 12 cases at autopsies on deaths due to accidental injuries. This group has been taken as representative of normals. Serum vitamin B₁₂ levels have also been estimated in 5 cases of hepatic

damage and 7 cases of chronic myeloid leukemia. In both these conditions, the vitamin levels were found to be raised. In 13 cases of tropical megaloblastic anaemia, the values were low. Normal values were found in 14 cases of iron deficiency anaemia and 4 cases of dimorphic anaemia. High values were found in one case each of tropical eosinophilia, leukemoid reaction and acute myeloid leukemia. One year following a gastrectomy, a low value was observed in one case.

Vitamin B₁₂ stores in the human body. Part II. Vitamin B₁₂ content of tissues in health and diseases, by Jhala, C. I. and Gadgil, R. K., *Ann. Biochem. exptl. med.*, 1959, 19 (12), 293. —The vitamin B₁₂ contents of the liver, spleen, kidney, spinal cord, tongue and serum in normal subjects have been determined. Vitamin B₁₂ contents of the liver, spleen, kidney and serum have been studied in one patient each of tropical megaloblastic anaemia and chronic myeloid leukemia and in four cases of hepatic damage. The significance of the findings is discussed.

A study of haemoglobin synthesis by rat blood reticulocytes with special reference to vitamin B₁₂ and folic acid deficiency states, by Mulgaonkar, A. G. and Sreenivasan, A., *Ann. Biochem. exptl. Med.*, 1959, 19 (12), 299. —Rat blood reticulocytes synthesize haemoglobin from essential amino acids in presence of glucose *in vitro*. Additions of glycine and Fe⁺⁺ stimulate this synthesis. Anaerobiosis and haemolysis prevent it.

Plasma from normal rat inhibits haemoglobin synthesis. This inhibition is partially overcome by addition of Fe⁺⁺ to the incubation mixture or by heat coagulation of plasma proteins. Addition of Fe⁺⁺ to filtrate of boiled plasma totally reverses the inhibitory effect. Under these conditions there is a stimulation of haemoglobin synthesis by plasma filtrate.

Plasma from phenylhydrazine-treated rats, in contrast to plasma from normal animals, stimulates haemoglobin synthesis. This activity tends to increase during recovery of the animal from phenylhydrazine treatment.

Reticulocytes are capable of synthesizing considerable haemoglobin in plasma of vitamin B₁₂ and folic acid deficient animals. Plasma of animals singly deficient in either vitamin or that from control animals fails to support haemoglobin synthesis. In the presence of adequate amounts of essential amino-acids in the reaction mixture, plasma of doubly deficient animals is ineffective.

Red blood cells of vitamin B₁₂ and/or folic acid deficient animals fail to synthesize significant quantities of haemoglobin from essential amino-acids and glycine. Administration of the deficient vitamin(s) to the animals, 16 hours prior to the experiment, does not improve the ability of the cells to synthesize haemoglobin from essential amino-acids unless glycine is also added to the reaction mixture.

In a preliminary experiment the effects *in vitro* of vitamin B₁₂ and folic acid and, additionally, of citrovorum factor on haemoglobin synthesis by the red blood cells of the doubly deficient animals have been examined. In a medium containing essential amino-acids, glycine, iron, a plasma filtrate, glucose and phosphate, addition of vitamin B₁₂ causes a significant increase in haemoglobin synthesis whereas folic acid is ineffective in the absence of vitamin B₁₂. CF alone produces an effect comparable to that of vitamin B₁₂ and folic acid together. Inclusion of vitamin B₁₂ in a medium containing CF does not improve upon the activity of the latter, suggesting that the effect of vitamin B₁₂ is through increased CF synthesis.

Preparation of a balanced stock diet for laboratory animals (rats and mice), by Dhar, D. C., *J. sci. industr. Res.*, 1959, 18C (12), 250. —A stock ration in pallet

form has been made out of indigenous materials like sesame seed cake, Bengal gram and yeast for the feeding of experimental animals like rats and mice. The diet keeps well and supplies all the essential requirements of vitamins, minerals and amino acids. The growth, reproduction and lactation capacity of the rats reared on this diet compare well with those of rats kept on normal stock ration.

DAIRY

The effect of temperature on the creaming of buffalo milk, by El-Hagarawy, I. S. and Rakshy, S.E.S.E., *Indian J. Dairy Sci.*, 1959, 12, 117. —The creaming behaviour of both cow and buffalo milk at different temperatures was investigated. Creaming in cow milk reached its maximum at 40°F and its lowest at 100°F. There was no big difference in the creaming tendency at 77°F and at 100°F. On the contrary, creaming in buffalo milk reached its maximum at 100°F and was lowest at 40°F.

Chemical composition of chakka, by Ganguly, S., *et al.*, *Indian J. Dairy Sci.*, 1959, 12, 121. —*Chakka* is a high protein food obtained from *dahi* by draining off the whey. It is used in making several indigenous food preparations. The method of preparation of *chakka* is simple and consists in leaving milk with sufficient quantity of starter overnight and in the morning the *dahi* is hung in a clean cloth for about 6 hours so that all the whey is drained out. It is commonly found that fat is removed from the milk before making *chakka* and as such it is necessary to know the chemical composition of *chakka* and also lay down some chemical standards for the product. The authors have analysed 52 samples of *chakka* prepared in the laboratory. The average percentage composition is reported as follows: moisture, 59.58; fat, 22.4; ash, 1.03; total nitrogen, 1.62; total protein, 10.3; and acidity as lactic acid, 2.32. The maximum

and minimum values have also been reported.

K.L.R.

Tocopherol content of Indian butter and its use in detecting adulteration of butter-fat, by Nazir, D. J. and Magar, N. G. *Indian J. Dairy Sci.*, 1959, 12, 125.—A few samples of Indian butter-fat were examined for their tocopherol content by the saponification method of Dunford. A comparison of the results obtained by the Emmerie-Engel and the PMA methods showed that the former gave slightly higher values. Fifty three samples of butter and 81 samples of butter-fat were examined and the average tocopherol content was 3.1 and 2.9 mg./100g. for butter and butter-fat respectively.

Ten samples of butter-fat, adulterated at three different levels, viz., 5 per cent, 10 and 15 per cent, with various adulterants with widely differing tocopherol values were examined for their tocopherol content. Adulteration at a level of 10 per cent and above could be detected in all the cases attempted here, while many of the adulterants could be detected at a level as low as 5 per cent. However, the method is useful only if the oils used for adulteration are rich sources of tocopherol.

Co-vitamin studies. Part IV. Stability of tocopherol, carotene and vitamin A in ghee during storage, by Narayanan, K. M. and Anantakrishnan, C. P., *Indian J. Dairy Sci.*, 1959, 12, 133.—During the storage of ghee the stability of tocopherol and vitamin A in cow and buffalo ghee depended upon the method of preparation. Vitamins were found to be relatively less stable in *desi* ghee than in cream or creamery ghee during storage.

During the storage period, the extent of destruction of vitamin A in cow ghee prepared by cream and creamery methods was slightly less than that of buffalo ghee prepared by similar methods. This difference in the stability of vitamin A

was not apparent in *desi* ghee from cows and buffaloes.

The loss of tocopherol at different stages of storage was practically the same in both cow and buffalo ghee prepared by direct cream heating method.

Peroxide development at various stages was more in buffalo cream ghee than in cow cream ghee. However, such difference was not noticed in cow and buffalo ghee prepared by *desi* method.

FRUIT AND VEGETABLE PRODUCTS

Bioflavonoids from Indian vegetables and fruits, by Ganju, K. and Puri, B., *Indian J. med. Res.*, 1959, 47 (5), 563.—A systematic survey for the presence of bioflavonoids by the method of filterpaper chromatography (horizontal migration) and their characteristic colour reactions has revealed their presence in large number of vegetables and fruits. Quercitrin (quercetin glycoside) has been isolated from the eight leafy vegetables in the form of its quercetin content (about 500 parts per million). The vegetables from which quercetin was isolated also indicated the presence of vitamin K, i.e., about 200-250 parts per million.

MICROBIOLOGY

Studies on heat resistance of *Bacillus subtilis* spores: Part I. Effect of different chemicals, by Bose, A. N. and Roy, A. K., *J. sci. industr. Res.*, 1959, 18 C (12), 248.—The heat resistance at 110° C in solutions of different concentrations of sodium chloride, calcium chloride, sucrose, glucose, acetic acid, propionic acid and butyric acid, of the spores of a strain of *B. subtilis*, isolated from spoilt commercially canned vegetables has been determined. While lower concentrations of sodium chloride (1 per cent) have no effect or increase the heat resistance of the spores slightly, calcium chloride even at low concen-

trations (0.01 per cent) causes marked lowering. The susceptibility of the spores to thermal destruction at 110 C° progressively increases with increase in sucrose concentration from 15 to 55 per cent, but only at about 55 per cent sucrose concentration the rate of destruction of the spores is markedly higher than that in distilled water. The effectiveness of water-soluble fatty acids in lowering the heat resistance of the spores increases rapidly with rise in the molecular weight of the acid.

OILS AND FATS

Chemical examination of the oil from the seeds of citrus microcarpa, by Agrawal, S. R., Agrawal, R. P. and Gupta, G. N., *J. & Proc. Inst. Chem.*, 1959, 31 (5), 207.—*Citrus microcarpa* Bunge, known as Chinese orange is grown in North India for its edible fruit. Each fruit contains 5-10 seeds having a fixed oil. Extraction of the seeds with ether yielded a light pale greenish yellow, pleasant smelling oil to the extent of 25.8%. The characteristics of the oil are given. The fatty acid composition of this non-drying edible oil as determined by the urea adduct method and confirmed by ultra-violet absorption spectra is as follows: palmitic, 15.4; stearic, 22.6; oleic, 33.9; and linoleic acid, 28.2 per cent.

K.L.R.

SPICES

Further studies on the legal standards of greater cardamom (*Bara illacyhi*), by Mitra, S. N., Sengupta, P. N. and Bose, P. K., *J. & Proc. Inst. Chem.*, 1959, 31 (5), 232.—The present legal limits for total and acid-insoluble ash are 8.0 (maximum) and 3.0 (maximum) per cent respectively. The values seem to be on the liberal side. The AA have analysed ten samples of whole *bara illaychi* with the skin and 19 samples of the seeds without the skin for loss in weight at 100°C, total and acid insoluble ash and volatile oil contents with

a view to verifying the correctness of the present standards. The maximum, minimum and average values obtained are given. The results indicate conclusively that

the total and acid-insoluble ash contents are far less than the prescribed standards which are on the high side. The present standard for volatile oil (not less than 1.0 per

cent) seems to be in order. The results obtained will be useful when reviewing the specifications for this spices.

K.L.R.

PART III (Foreign)

ANALYTICAL

A gas chromatographic method for determining gases in the headspace of cans and flexible packages, by Stahl, W. H. *et al*, *Food Technol.*, 1960, 14 (4), 14.—Utilizing inert gases for the prevention of quality deterioration in packaged foods has been practiced successfully for many years. Although it is generally agreed that the determination of the concentration of these gases is of extreme importance, no practical methods are available which encompass the wide range of packages encountered. As is commonly known, the orsat method, generally used throughout the food industry, requires a large volume of sample, is time-consuming, and, when reduced to a micro scale, becomes extremely complicated. Commercial oxygen analysers require smaller sample volumes, but are limited to the analysis of oxygen. Gas chromatographic methods, however, require less than 1 ml. of gas for satisfactory analysis, are extremely rapid, and quite versatile. The procedure used successfully for several months by the authors of this article employs a simple sampling method which can be adapted to any container, followed by gas chromatographic analysis. The method allows analysis on not more than 0.5 ml. of gas, requires 7 minutes per determination, can be run by a technician, and is sufficiently accurate for the purpose intended.

Determination of amylose in starch, by Carroll, B. and Cheung, H. C., *J. agric. Fd. Chem.*, 1960, 8 (1), 76.—Congo red is used colorimetrically for the determination of amylose in starch. Adsorption of the dye is independent of the chain length of the poly-

saccharide over a wide range. The extinction coefficient of the adsorbed dye is the same for both amylose and dextrin. The results are discussed and compared with those obtained from the usual iodine sorption and colorimetric methods.

BIOCHEMISTRY AND NUTRITION

Comparison of the amino-acid composition of the protein in flour and endosperm from different types of wheat, with particular reference to variation in lysine content, by McDermott, E. E. and Pace, J., *J. Sci. Fd. Agric.*, 1960, 11 (2), 109.—The amino-acid composition of the protein of two flours, one milled from Manitoba wheat and the other from Hybrid 46, differing markedly in protein content and baking characteristics, was determined. The protein in both flours was generally similar in composition but there were small differences between the two in the content of lysine and arginine. This observation was extended by determining the lysine content of six flours, from different varieties of wheat, which had protein contents ranging from approximately 6.7 per cent to 14.0 per cent. It was found that as the protein content of the flours increased the lysine content of the protein decreased.

The same inverse relationship, between the content of protein and the amount of lysine in the protein, was observed in samples of endosperm obtained by microdissection from wheats of different protein content. It was also found when samples of endosperm with a vitreous character were compared with those of mealy type, from grains of the sample

of the same variety of wheat. Vitreous endosperm had a higher protein content than mealy endosperm but the lysine content of the protein was lower.

Effect of cooking rice with different volumes of water on the loss of nutrients and on digestibility of rice in vitro, by Malakar, M. C. and Banerjee, S. N., *Food Res.*, 1959, 24 (6), 751.—The average losses of nutrients during washing of five pure strains of rice prior to cooking have been found to be about thiamine 5 per cent, riboflavin 17 per cent, niacin 9 per cent, calcium 10 per cent, phosphorus 5 per cent, phytin phosphorus 4 per cent, iron 21 per cent, available iron 25 per cent, and nitrogen 2.3 per cent. The average losses (over the loss during washing) of these nutrients in *gruel* of rice cooked with six volumes of water are: thiamine 28%, riboflavin 27%, niacin 30%, calcium 17%, phosphorus 17%, phytin phosphorus 11%, iron 18%, available iron 20%, and nitrogen 5%. These losses increase when the rice is cooked with 8 volumes of water and are 35%, 34%, 39%, 25%, 20%, 18%, 24%, and 8% respectively. The retention of the nutrients in rice corresponds well with the values as calculated from loss of nutrients in the *gruel*. The loss of nutrients in rice cooked with just sufficient water is negligible. It was also observed that the rice cooked with more water was more digestible *in vitro* than the rice cooked with less water. The *in vitro* digestibility of rice cooked with just sufficient water was the least.

COFFEE

Effect of temperature during the roasting cycle on selected

components of different types of whole bean coffee,

by Merritt, M. C. and Proctor, B. E., *Food Res.*, 1959, 24 (6), 672.—The effect of temperature at specific temperatures during the roasting cycle on selected components of whole bean coffee types, namely, total soluble solids, caffeine, trigonelline, chlorogenic acid, and tannin, has been investigated. Seven different types of coffee, including Santos, Maracaibo-Cuban, Medellin-Armenia, Post-Crop Colombian, Old-Crop Bucaramanga, Peruvian, and Central American, were analysed, and the per cent retention for each component noted. Total soluble solids decreased gradually until 375°F. was reached, and then increased with temperature to the end of the roasting cycle. Caffeine increased directly with temperature, the increase being gradual for Post-Crop Colombian, Old-Crop Bucaramanga, and Peruvian coffee. For Maracaibo-Cuban and Medellin-Armenia coffee, the change with temperature was immediate, followed by a gradual increase to the end of the roasting cycle. Trigonelline decreased with temperature. For Post-Crop Colombian and Old-Crop Bucaramanga coffee, this component remained fairly constant, except for an initial drop, until after 350°F. was reached. Chlorogenic acid and tannin decreased fairly rapidly with temperature throughout the roasting cycle.

Extraction rates for selected components in coffee brew,

by Merritt, M. C. and Proctor, B. E., *Food Res.*, 1959, 24 (6), 735.—The effect of time and temperature on extraction rates for soluble solids, colour, caffeine, trigonelline, chlorogenic acid, and tannin, in coffee brew has been investigated. Brew extracts were prepared for intervals of 0.5, 1, 2, 5, and 10 minutes, and for temperatures of 200°F., 180°F., 160°F., 140°F., 120°F., and 100°F. Extraction rates for each component increased with increasing temperature of

extraction. In respect of time, extraction rates for soluble solids, colour, and chlorogenic acid showed an increase over the 10 minute period of study, the increase being less pronounced after the first two minutes. Extraction rates of the components studied decreased in the following order: trigonelline, caffeine, soluble solids, chlorogenic acid, tannin and colour. Time had no apparent effect on rate after the first five minutes for trigonelline at temperatures of 140°F.-200°F.

Carbohydrates of the coffee bean,

by Wolfrom M. L., *et al.*, *J. agric. Fd. Chem.*, 1960, 8 (1), 58.—The carbohydrates of green and roasted Santos coffee were identified and measured. The soluble sugars of green coffee were sucrose, glucose and fructose. The holocellulose fractions of green and roasted coffee were isolated. The 10 per cent potassium hydroxide-insoluble holocellulose of green coffee was hydrolyzed by a new method employing anhydrous sulfuric acid. It contained the following ratio of sugars: L-arabinose, 1; D-galactose, 2; D-glucose, 2; D-mannose, 6. Little, if any lignin, cellulose, or pectin was found. The holocellulose was partially solubilized on roasting. The arabinose was easily acid-hydrolyzable. Other coffee constituents identified and estimated were caffeine, trigonelline, caffeic acid, chlorogenic acid, 'isochlorogenic' acid, and 10 amino acids. The free amino acid disappeared on roasting. A method was developed for locating caffeine on chromatograms.

FLAVOUR

Flavour compounds from commercial evaporated milk,

by Dutra, R. C., *et al.*, *Food Res.*, 1959, 24 (6), 688.—Evaporated milk was steam-distilled in an assembly which minimizes additional heat damage, and the distillate, which possessed the typical flavour and odor of evaporated milk, was concentrated and extracted with ethyl chloride. Infrared studies indicated that the material ex-

tracted was a mixture of carbonyls. The 2,4-dinitrophenylhydrazone mixture was resolved into three fractions by column chromatography using two different procedures. They were identified as acetaldehyde, 2-pentanone and 2-heptanone, and the identification confirmed by paper chromatography. Results of tracer studies showed that acetaldehyde is derived both from lactose breakdown and deamination and decarboxylation of alanine. Lactose was also found to be the precursor of another carbonyl fraction which could not be completely characterized. Hydrogen sulphide was evolved during the steam distillation, but there was no evidence of mercaptans.

FRUIT AND VEGETABLE PRODUCTS

Anthocyanase activity and its possible relation to scald in sour cherries,

by Wagenknecht, *et al.*, *Food Technol.*, 1960, 14 (1), 47.—Scald of sour cherries has been shown to be caused by a combination of bruising and time-temperature effects related to picking, transportation, and other pre-processing conditions. This phenomenon is characterized by a migration of the red anthocyanin pigment from the skin into the flesh of the fruit, followed in turn by the loss of the pigment and the appearance of a brown discolouration. This report is concerned with an enzyme system in sour cherries capable of causing the destruction of anthocyanins and a consideration of some of its properties. The anthocyanase activity of several varieties of sweet cherries and of several types of berries was determined at various stages of maturity. Anthocyanase is believed to participate in the early stages of scald in red sour cherries through destruction of anthocyanin pigments. Sour cherry anthocyanase was prepared from homogenates of fresh fruit and partially purified from press juice by ammonium sulfate precipitation. The enzyme has

limited solubility in water and exhibits maximum activity at pH 5.7 to 6.0. The enzymatic activity of a homogenate of fresh cherries was nearly doubled by the addition of catechol. Purified enzyme preparations were nearly inactive unless catechol was added. The optimum concentration of catechol was 0.01M. The anthocyanase of sour cherries requires the participation of oxygen for activity and was inhibited by thiourea. Sour cherry anthocyanase is quite similar in its properties to *Coleus* cyanin oxidase, and is dissimilar to fungal anthocyanase. The presence of anthocyanase has also been demonstrated in sweet cherries, black raspberries, blackberries and blueberries. The amount of enzyme activity in these fruits at several stages of maturity has been studied.

Pink discolouration in canned Bartlett pears, by Luh, B. S., Leonard, S. J. and Patel, D. S., *Food Technol.*, 1960, 14 (1), 53.—In this article the effects of growing area, soil types, and processing conditions on pink colour development in canned Bartlett pears are reported. A method for quantitatively determining the pink colour precursor is presented. The pink pigment in the canned product was investigated by chromatographic methods. Growing area and soil types were found to be related to this problem. Pears from certain growing areas had low pH, high acidity, and high tannin content. These pears were found to develop pink colour after canning, especially when excessive heating and delayed cooling processes were used. The pink pigment in canned pears was shown to be identical in Rf value to that of cyanidin.

Lye-pressure steam peeling of potatoes and other products, by Adams, H. W., *et al.*, *Food Technol.*, 1960, 14 (1), 1.—Whether a mechanical lye peeler or a steam peeler is used, each has its limitations. However, a comparatively new method, pre-coating products

with hot caustic solution, and then subjecting them to atmospheric steam under pressure, has been shown to offer greater flexibility than other techniques, and better process control. This paper presents the advantages of such a system—comparing its labour saving, yield, and flexibility of application against the same factors when steam or lye alone is used. Since processors are becoming more and more cognizant of the costs of operation and yield, the concepts introduced here should be of much interest. Also studied were the holding times in lye and steam in order to determine peel loss and peeling efficiency. Correlation of surface area to peel loss was studied, using Idaho potatoes. As surface areas increase, peel loss is decreased. Five per cent lye followed by 45 seconds at 75 p.s.i.g. steam resulted in good peeling, the peel loss being 14.6 per cent. Addition of a wetting agent to 5 per cent lye, followed by steam produced good results with high yield. Cost analyses on three peeling methods indicated lye plus steam is the most economical method of peeling.

Studies on the retention of ascorbic acid during blanching of some Indian vegetables, by Malakar, M. C. and Banerjee, S. N., *Food Res.*, 1959, 24 (6), 749.—Ascorbic acid is lost to a considerable extent during blanching of vegetables before canning. Different methods have been suggested to minimise this loss. In this paper, the effect of blanching of Indian vegetables in different media on the retention of ascorbic acid has been reported. Eight different vegetables, *viz.*, *patol*, cabbage, bitter gourd, *kankrol*, *barbati*, French beans, cluster beans and potato have been used in the study. Their initial ascorbic acid content was determined. The vegetables were then blanched for 4 minutes at 82 °C in the following media: (1) water (2) 0.11 per cent sodium sulphite solution, (3) water after dipping the vegetables in 0.5 per cent sodium

sulphite solution for $\frac{1}{2}$ minute at R.T. (4) water after dipping the vegetables in a mixture of 0.075 per cent sodium sulphite and 5 per cent brine solution for $1\frac{1}{2}$ minutes at R.T. and (5) lactic acid solution of pH 3.5. After blanching, the vegetables were strained, cooled and analysed for ascorbic acid. The results show that blanching in acid solution helps in maximum retention (70-96 per cent) of ascorbic acid. The next best method was blanching in 0.11 per cent sodium solution. Dipping in sulphite solution with or without sodium chloride and then blanching in water had some beneficial effect. It was found, however, that the culinary qualities deteriorated in samples blanched in acid medium while blanching in sulphite solution produced a slight improvement. The other treatments had little effect on culinary qualities. Blanching the vegetables in sulphite solution thus appears to be the best from the point of view of retention of ascorbic acid and better culinary quality.

K.L.R.

Reddening of white onion tissue, by Joslyn, M. A. and Peterson, R. G., *J. agric. Fd. Chem.*, 1960, 8 (1), 72.—Factors affecting the formation of the water-soluble, red nitrogenous pigment in acidified white onion puree were investigated. The presence and absence in onions of several compounds are reported. Added acetic acid was not necessary for pigment formation, and its great enhancing effect was traced to the 1 to 3 p.p.m. of formaldehyde which occurs in reagent glacial acetic acid as an impurity. Other similar compounds such as diacetyl, acetoin, and glycolonitrile can replace formaldehyde in the reddening reaction, and studies were made in an effort to identify the natural occurring carbonyl compound. A type-reaction mechanism for the pigment formation is postulated and discussed.

INSECTICIDES

Mechanisms of insect resistance to the chlorohydrocarbon,

by Bradbury, F. R. and Standen, H., *J. Sci. Fd. Agric.*, 1960, 11 (2), 92.—A review is made of the mechanism of the resistance of houseflies (chiefly) to BHC and DDT, especially as regards apparent contradictions in existing knowledge. Points discussed include differences between susceptible and resistant houseflies as regards penetration and metabolism of the insecticide.

MALTING

Factorial laboratory malting, by Bishop, L. R. and Spaul, M. D., *J. Inst. Brew.*, 1959, 65 (6), 504.—Simple and inexpensive apparatus is described together with a procedure which makes it possible for the ordinary malting laboratory to test and find within a fortnight the best of a wide range of malting treatments for any sample of barley, so that large-scale malting can be carried out without delay or loss. The essence of the method is the use of the 'factorial' or 'latin square' method by which all combinations of a wide range of malting conditions are tested at the same time and with the minimum of labour.

GENERAL

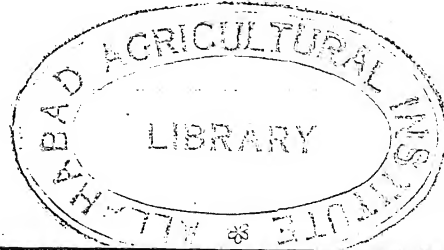
The stabilizing of tin-plate surfaces, by Neish, R. A. and Donelson, J. G., *Food Technol.*, 1960, 14 (1), 37.—The oxide film normally present on tin, although protective to some degree, readily grows to such an extent that discolouration of the surface is easily discernible. This oxidation and the accompanying discolouration, commonly called 'yellow-stain', can occur during storage in warehouses under humid conditions or during the baking operation that follows lacquering or enameling. However, it is not only the change in the appearance of the tin plate that is objectionable; the oxide film formed during warehouse storage can prevent the proper adherence of some lacquers and lithographing inks to the tin surface, and can

cause difficulty during modern, high-speed soldering operations in the manufacture of cans. Treatments to minimize baking discolouration and warehouse deterioration of tin-plate surfaces were investigated. Several reagents were found to be effective for this purpose. Of these, sodium dichromate was the most practical for commercial use. However, the protection obtained is limited if the normal air-formed oxide lies beneath the protective film. This is best accomplished by cathodic reduction in the passivating solution followed by chemical or electrochemical oxidation in the presence of the passivating agent. Protective films formed on tin-plate by either of these methods, though invisible and very small in thickness, provide an effective barrier between metal and oxygen. Films formed by the electrochemical reduction and reoxidation method, however, are more stable, more resistant to sulfide staining, and more resistant to attack by dilute reagents. On the other hand, films formed by this method are not entirely satisfactory with a few lacquers used by the can industry. Although research is continuing in an attempt to produce protective films that are satisfactory with all tin-plate lacquers, it is hoped that new lacquers may be developed that will permit utilization of the protective films most resistant to oxidation.

Pregelatinized starches for the food processor, by Waldt, L. M., *Food Technol.*, 1960, 14 (1), 50.—A pregelatinized starch is produced by cooking and drying the starch dispersion on heated rolls or drums. This process involves feeding a starch slurry (after completion of processing, refining, and blending with other starches, sugars, etc.) on the outer surface of a steam-heated revolving drum. The rate of rotation of the drum is set so that the material is

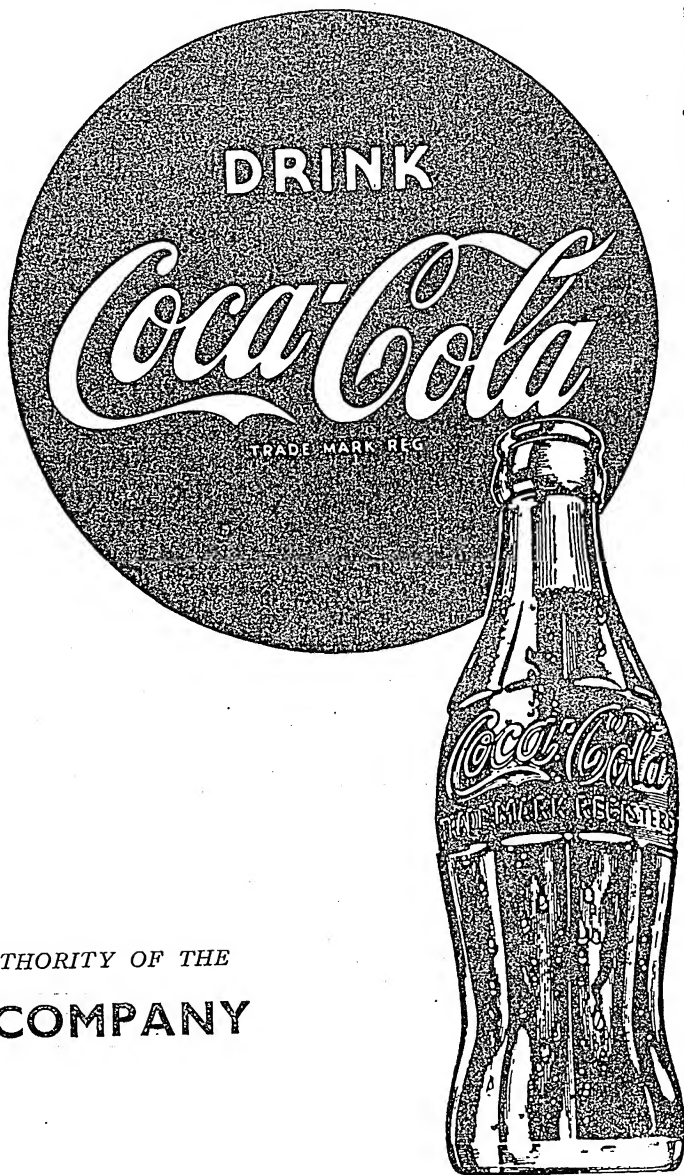
dried and scraped off by a doctor blade when the drum reaches a certain position. The operation can be performed on single or double drums, with the latter providing greater capacity. This pre-cooking process swells the starch granules and thus conditions them to thicken and gelatinize in cold liquids, without need for subsequent heating. Thus, the starch manufacturer is doing the actual starch cooking operation in his own plant. By this method, gelatinization time, gel texture, stability and composition can be engineered into the starch according to the requirements of the food manufacturer's equipment and the food product involved. Product uniformity from item to item and batch to batch is assured and the user is relieved of the costly cook-up and gelatinization control operations necessary with ordinary starches. Unfortunately, there is a dearth of literature (except for patent claims) on pregelatinized starch use and application. This paper outlines some of the advances made in the starch technology field in recent years and provides suggestions on how a food processor can take advantage of the properties of precooked starches through proper examination, control, and intelligent application.

Interaction on starch with sucrose stearates and other antistaling agents, by Bourne, E. J., *et al.*, *J. Sci. Fd. Agric.*, 1960, 11 (2), 101.—The reaction of sucrose monostearate (SMS) with starches and starch fractions is similar to that of various substances with 'antistaling' activity with starch. SMS forms an insoluble complex with starches and competitively inhibits the reaction of iodine with amylose. Wheat starch granules adsorb SMS and it is suggested that the formation of an insoluble complex on the surface of the granules may play a part in the 'antistaling' activity of SMS.



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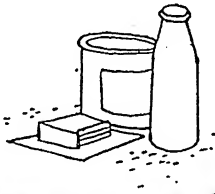
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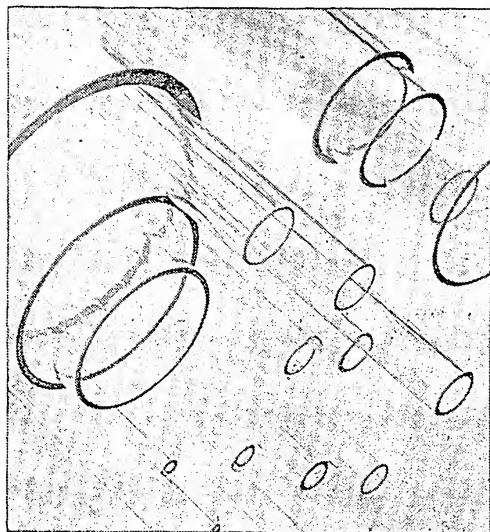
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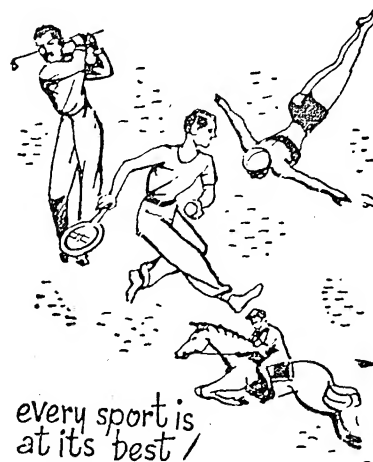


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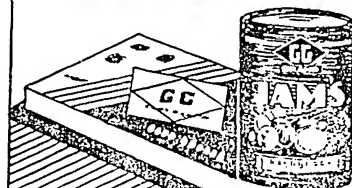


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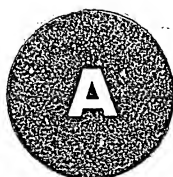
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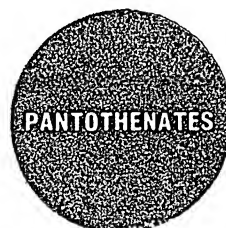


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Thiamine Mononitrate

BETA-CAROTENE



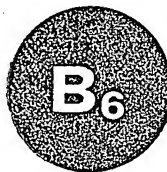
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| 13. Drying of Fruits. | 40. Preparation of Jack Fruit Jelly. |
| 14. " Vegetables. | 41. Preparation of Jack Fruit Pickle. |
| 15. Preparation of Jams. | 42. Preparation of Ginger Preserve and Candy. |
| 16. " Mango and other Preserves. | 43. Preparation and Preservation of Pineapple Juice. |
| 17. " Petha Candy. | 44. Canning of Pineapple. |
| 18. " Guava Jelly. | 45. Preparation and Preservation of Pineapple Jam. |
| 19. " Orange Marmalade. | 46. Canning of Sapota Segments. |
| 20. " Sweet Mango Chutney. | 47. Preparation and Preservation of Sapota Squash. |
| 21. " Guava Cheese. | 48. Preparation and Preservation of Sapota Jam. |
| 22. " Tomato Ketchup. | 49. Preparation and Preservation of Loquat Jam. |
| 23. " Mango Leather. | 50. Preparation and Preservation of Loquat Jelly. |
| 24. " Sweet Turnip Pickle. | 51. Preparation of Canned Loquats. |
| 25. " Mango Pickle in Oil. | 52. Dehydration of Ripe Bananas. |
| 26. " Lime and Green Chilli Pickle. | 53. Canning of Ripe Bananas. |
| 27. " and Preservation of Spiced Carrot Juice. | 54. Canning and Bottling of Processed Peas. |
| | 55. Preparation and Preservation of Almond Syrup. |

Indian Sweets Series

- | | |
|--|--|
| 1. Preparation and Preservation of <i>Shrikhand Wadi</i> . | 2. Preparation and Preservation of <i>Besan Wadi</i> . |
| 3. Preparation and Preservation of <i>Rossogolla</i> . | |

Substitute Food Series

- | | |
|----------------------------------|---|
| 1. Preparation of Soyabean Milk. | 5. Preparation of Bamboo Chutney (Sweet). |
| 2. " Synthetic Grains. | 6. Canning of Bamboo Shoots in Syrup. |
| 3. " Groundnut Milk. | 7. " " " " " Brine. |
| 4. " Bamboo Candy. | 8. " " " " " Curried Vegetables. |

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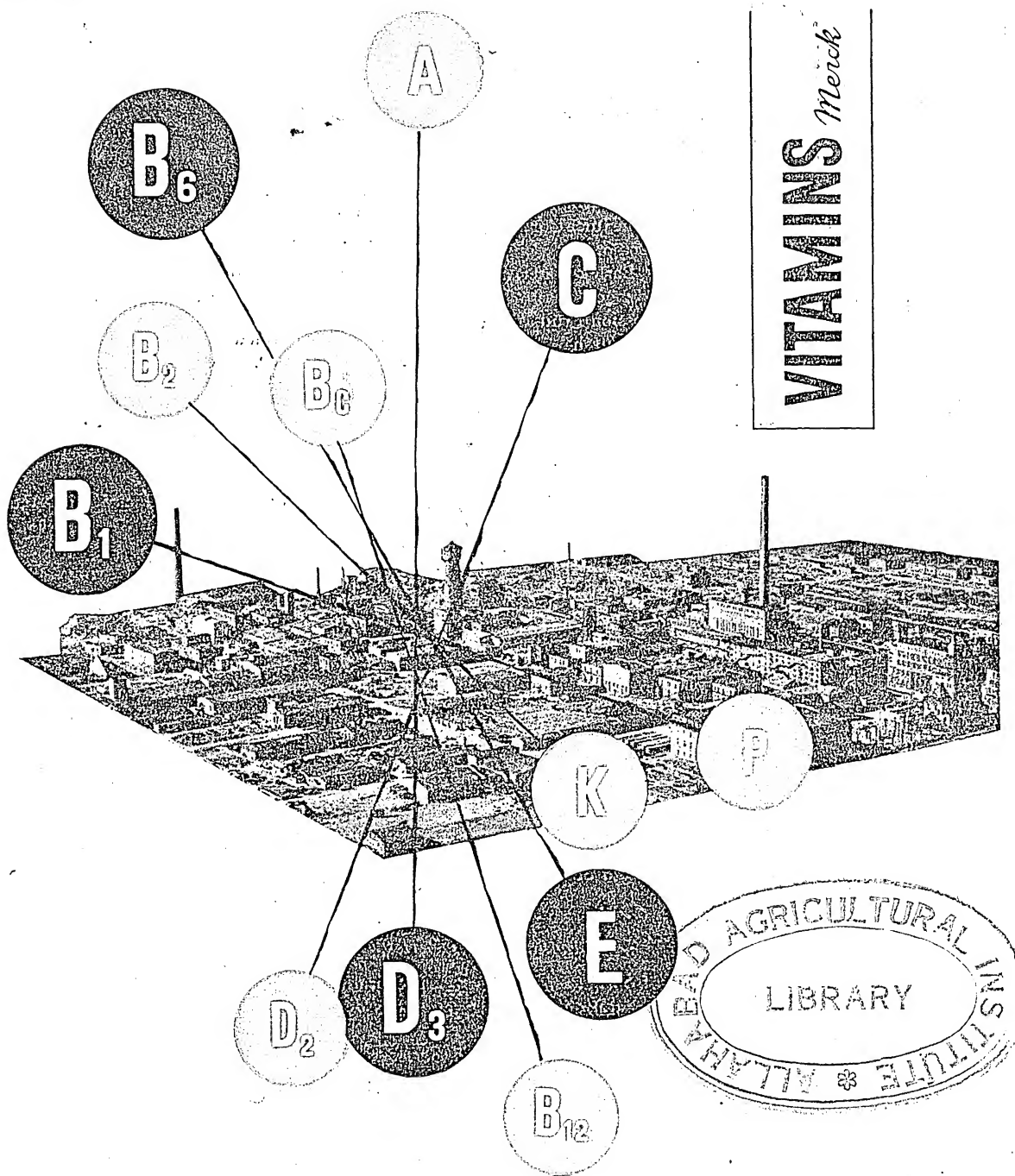
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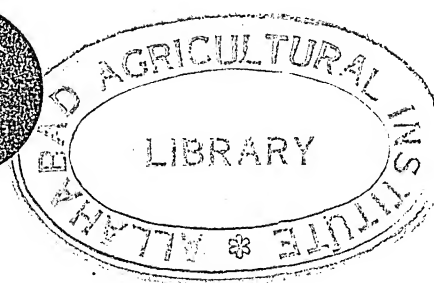
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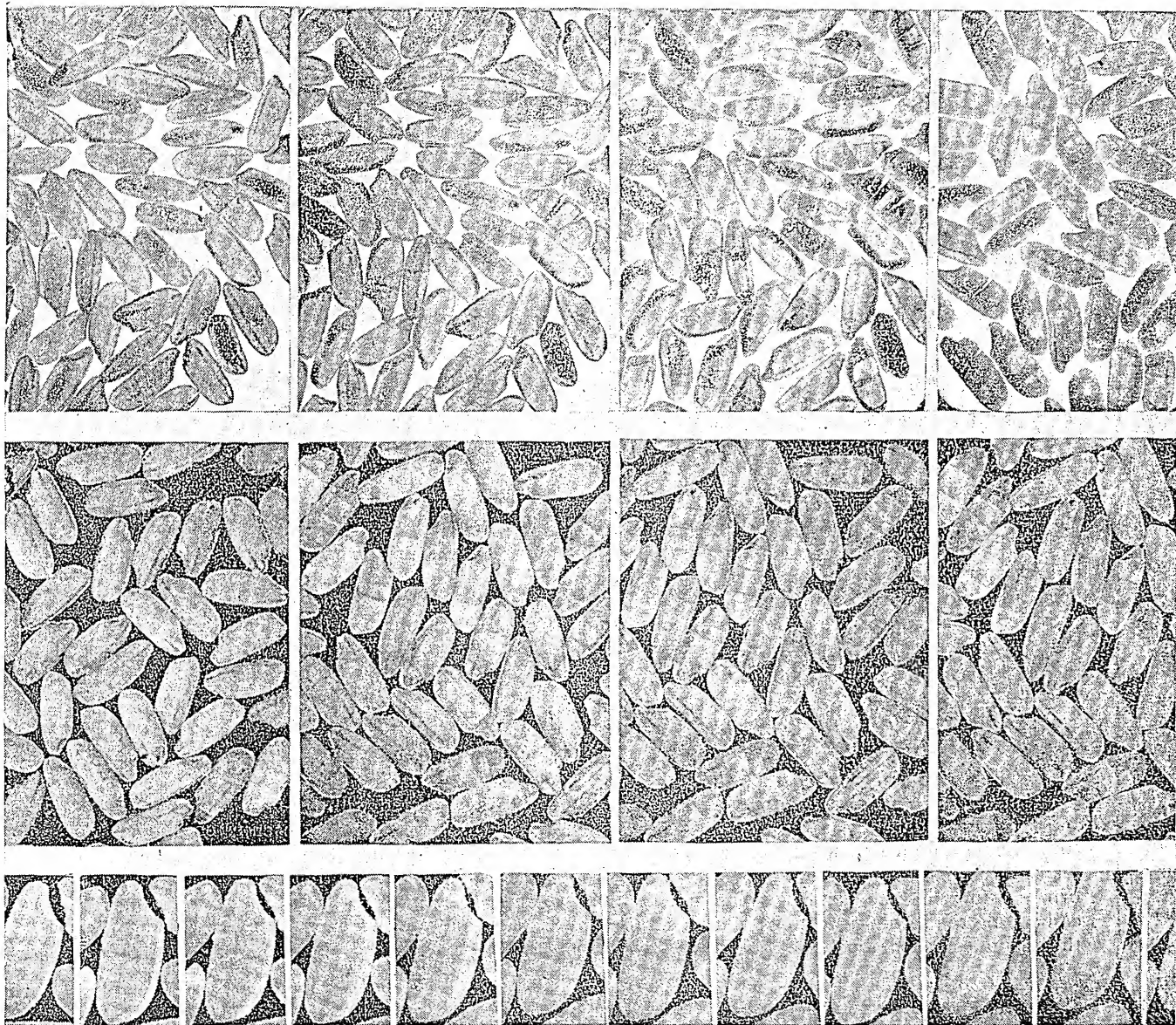
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FOOD

SCIENCE



CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE, MYSORE



SOME EFFECTS OF WETTING OF RICE GRAINS IN WATER

- A. Appearance and formation of cracks in raw rice at 1, 4, 7 and 12 minutes respectively after soaking.
- B. Development of cracks in parboiled rice after soaking for 15, 25, 30 and 35 minutes respectively.
- C. Changes in opacity of rice indicating the mode of penetration of water during wetting in a typical rice grain.

C.F.T.R.I. PUBLICATIONS

- 1. SOME ASPECTS OF FOOD TECHNOLOGY IN INDIA** (*published in August 1959*), pp. 160. (Editors—H. A. B. Parpia, R. C. Bhutiani, K. L. Radhakrishnan, A. N. Sankaran and B. V. Subbarayappa)

This is a publication specially brought out on the occasion of the F.A.O. Regional Seminar on Food Technology for Asia and the Far East held in Mysore from August 1-8, 1959. It is a collection of 26 review articles, which cover exhaustively the research work done in India on some of the important aspects of Food Science and Technology, particularly those dealing with rice and rice substitutes; fruit and vegetable products; dehydration of foods; storage, packaging and transport of perishables; infant, invalid and protein-rich foods; beverages, spices and condiments; etc. The book represents under one cover the important lines of work and progress made in India in the field of Food Technology.

Price: (Bound) Rs. 10.00 (*postage extra*); £1.5.0; \$ 4.00.
(Ordinary) Rs. 5.00 (, ,); £0.12.0; \$ 2.00.

- 2. FRUIT AND VEGETABLE PRESERVATION INDUSTRY IN INDIA** (*published in May 1956*) pp. xiv + 485. (Compiled and edited by R. C. BHUTIANI).

This publication is packed with up-to-date technical and statistical data on several aspects of the Fruit and Vegetable Preservation Industry spread over 65 papers read and presented by scientists, technologists, industrialists (manufacturers of food products, machinery, additives, containers and packaging) as well as importers and exporters. Some papers also bring out adequately the various stages of development of the Industry in the country and the handicaps with which it is faced today. The inclusion of the discussions which followed each of the papers read, has added to the usefulness of the book. It also contains the Recommendations of the Symposium submitted to the Planning Commission for consideration in respect of schemes to be included in the Second Five-Year Plan.

Price: Indian, Rs. 6.00 (*postage extra*); Foreign, 15 shillings; \$ 2.50

- 3. TECHNICAL AID TO FOOD INDUSTRIES** (*published in July 1954*), pp. xvi + 270. (Edited and Compiled by G. T. Kale, R. C. Bhutiani, N. V. R. Iyengar, V. Balu and A. N. Sankaran)

This publication, contains the views and suggestions of prominent scientists, leading industrialists and food technologists, and Government officials on the nature of technical aid needed by different food industries in the country. Up-to-date technical and statistical data are provided and an appendix embodying the conclusions of the Symposium as well as a comprehensive index are given.

Price: Indian, Rs. 5.00 (*postage extra*); Foreign, 10 shillings; \$ 1.75

- 4. FOOD AND POPULATION AND DEVELOPMENT OF FOOD INDUSTRIES IN INDIA** (*published in July 1952*) pp. xv + 357.

This book brings together the views and suggestions of leading thinkers, industrialists, scientists, demographers and other experts on the two topics. Packed with up-to-date technical and statistical data on several food industries such as fruit preservation, biscuit, chocolate, confectionery, glucose, flour-milling, food yeast, vanaspati, edible oils, fish processing, food machinery and the refrigerated preservation of perishable foods, this authoritative document brings into relief the handicaps and potentialities of these Industries in India. An appendix embodying the recommendations of a Committee of Experts, and a comprehensive index enhance the usefulness of the book.

Price: Indian, Rs. 5.50 (*postage extra*); Foreign, 10 shillings; \$ 1.75

STUDIES ON THE INSECT RESISTANCE OF PACKAGING MATERIALS—CELLULOSE AND POLYETHYLENE FILMS

By V. R. SREENATHAN, N. V. R. IYENGAR, K. S. NARASIMHAN AND S. K. MAJUMDER

(Central Food Technological Research Institute, Mysore)

Packaging of food products has undergone much change during recent years. Transparent flexible packaging materials are largely coming into use because in such containers food keeps fresh, clean and remains uncontaminated from foreign matters even during handling. In the food industry, cellulose films and polyethylene are increasingly coming into use due to certain advantages that these packaging materials possess such as transparency, toughness, lightness, flexibility, low permeability to moisture, odour and gas, heat sealability, and above all the 'sales appeal' that they offer to packaged goods. They have partially replaced the rigid containers such as the cans and glass bottles.

Packaging materials besides having the above desirable properties should also afford a reasonable protection against insect penetration. However, it has been noticed that some of the commonly used packaging materials are not insect-proof. Cellulose and polyethylene films are frequently

being used as packaging materials in India and information on the insect resistance of these films under the tropical conditions is lacking.

In India a variety of processed foods, confectionery products, dry fruits and dehydrated plant and animal products are being packaged increasingly in polyethylene and cellulose film packages. A random survey of the infested packed food articles revealed that *Tribolium castaneum* (Hub), *Sitophilus oryzae* (L.), *Rhizopertha dominica* (F) and *Oryzaephilus surinamensis* (Linne) constituted the majority of the beetle population. It was considered, therefore, necessary to study the relative insect resistance of various gauges of polyethylene and cellulose films to these four beetles.

Experimental

Packaging films: Polyethylene films and cellulose films were obtained from the leading manufacturers of these materials in India and the thickness was determined. While in the case of polyethylene film thickness in eight gauges were available, in the case of cellulose films one gauge was available. In the latter case both the plain, transparent and the moisture proof varieties were used for these studies.

The following test films were used:

Polyethylene: 100 Ga (0.001"), 150 Ga (0.0015"), 200 Ga (0.002"), 250 Ga (0.0025"), 300 Ga (0.003"), 400 Ga (0.004"), 500 Ga (0.005") and 600 Ga (0.006").

Cellulose film: 300 Ga (0.00094")—P.T. and 300 Ga (0.00094")—M.S.T.

Test insects: 2-3 weeks old adults of the test insects—*Sitophilus oryzae*, *Rhizopertha dominica*, *Tribolium castaneum* and *Oryzaephilus surinamensis* were drawn from laboratory cultures. The adults having uniform size were selected as far as possible. The test insects were kept under starvation for a period of 24 hours prior to releasing them on the test films and packages.

FOOD SCIENCE

JUNE 1960

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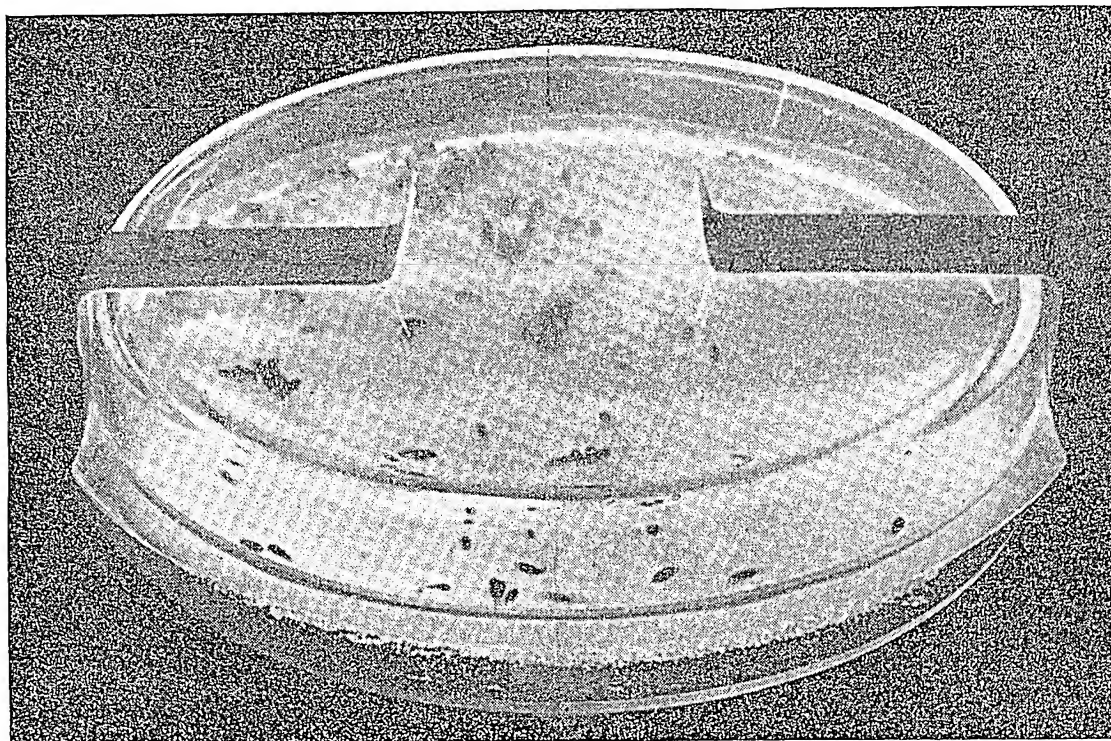


FIG. 1. Petridish-insect penetration test assembly for packaging films

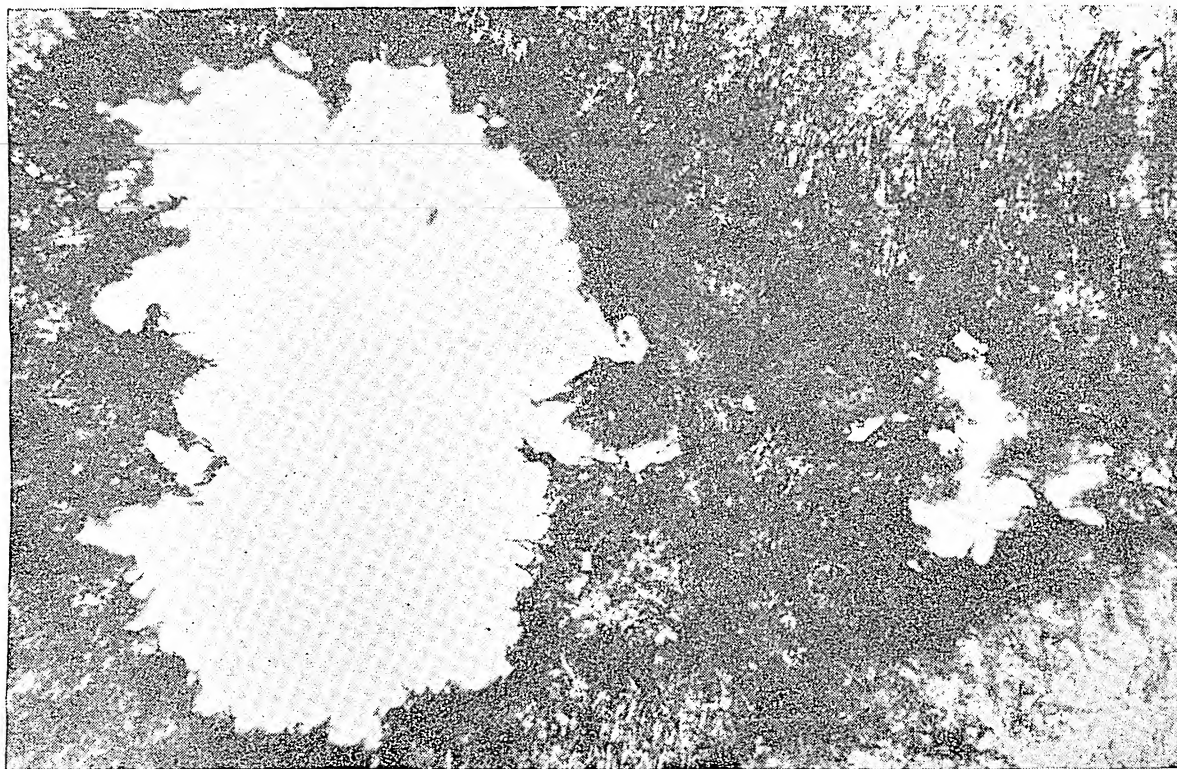


FIG. 2. Showing the nature of the chewed polyethylene film.

Insect penetration tests: The resistance to insect penetration of the test films were carried out in two series of tests.

(i) In the first series of tests, petridishes of 14.5 cm. diameter having 3 mm. thick ground rims were used. In the lower dish 5 g. of food mixture containing 30 per cent coarsely ground wheat, 30 per cent wheat semolina and 40 per cent wheat flour were placed. One hundred test insects of one species were transferred to the top petridish and was placed over a test packaging film on the lower dish. The test insects were confined on the test film held between the two dishes on their rims and securing with suitable U-spring type clamps. The arrangements for this test has been shown in Figure 1. There were three replicates for each insect species for every test film. The test dishes were incubated at room conditions: 25-28°C, R.H. 50 per cent; room temperature and 25 per cent R. H.; 21.1°C and 70 per cent R.H.; and 37.8°C with 95 per cent R.H. The test dishes carrying the test films were examined daily for insect penetration. The

test was carried out for a period of three weeks during which period either the test insect chewed through the film and reached the food or eventually died of starvation having failed to penetrate the film barrier. The results of the test are presented in Table I.

(ii) In the second series of tests, the packaging films were made into bags of 15 cm. × 10 cm. size and filled with the food mixture mentioned above. One hundred adults of the test species were released in each packet and the packet was heat sealed. Development of kinks and folds on the films was avoided during the preparation of the test bags. The test packets were placed in petridishes and the film surfaces were examined daily for insect penetration. The incubation of the bags were carried out at 25-28°C with R.H. 50 per cent, 21.1°C and 70 per cent R.H. and 37.8°C with 95 per cent R.H. for 12 weeks. Packages were considered to be penetrated only if the insect actually chewed through the film. If the insects obtained entry through a tear or defective seal the package was discarded.

TABLE I. *Studies on the insect resistance of cellulose and polyethylene films*

Gauge	Thickness	Temp. 26-28°C, R.H. 20%			Temp. 26-28°C, R.H. 50%				Temp. 21°C, R.H. 70%				Temp. 37°C, R.H. 95%			
		C	R	T	C	R	O	T	C	R	O	T	C	R	O	T
300	0.00094" P.T.	...	-	+	-	+	+	-	+	+	+	-	+	+	+	+
300	0.00094" M.S.T.	...	-	-	-	+	+	-	+	+	+	-	+	+	+	-
100	0.001"	...	+	+	+	+	+	-	+	+	+	+	+	+	+	+
150	0.0015"	...	+	+	+	+	+	-	+	+	+	-	+	+	+	-
200	0.002"	...	+	+	+	+	+	-	+	+	+	-	+	+	+	-
250	0.0025"	...	+	+	-	+	+	-	-	+	+	-	-	+	+	-
300	0.003"	...	-	-	-	+	+	-	-	+	+	-	-	+	+	-
400	0.004"	...	-	-	-	-	+	-	-	-	+	-	-	-	+	-
500	0.005"	...	-	-	-	-	-	-	-	-	-	-	-	-	-	-
600	0.006"	...	-	-	-	-	-	-	-	-	-	-	-	-	-	-

C = *Sitophilus oryzae*.

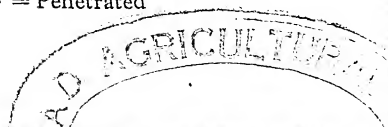
R = *Rhizopertha dominica*.

O = *Oryzaephilus surinamensis*

T = *Tribolium castaneum*

- = Not penetrated

+ = Penetrated



Tests were repeated three times. The results are presented in Table I and the nature of the chewed film by the test insects is shown in Figure 2.

Results and Discussion

A number of factors such as the types of insect pests, the ecological conditions, properties of the packaging films as modified at different temperatures and humidities, defects in the materials with reference to the presence of rough surfaces, folds and pin holes which often occur during manufacture, regulate the degree of resistance or susceptibility to insect penetration during their use in practice.¹ The films tested were carefully selected and subjected to meticulous handling to avoid these defects. The four species of test insects of common occurrence in packaged food articles, having biting and chewing mouth parts and capable of boring through hard surfaces such as grain were selected for the studies. In the present study the petridish-insect-penetration-test assembly was found to be more convenient than the 'cup-test' type used by earlier workers^{2,3,4} (Fig. 1). Under the conditions of the experiment the lower gauges of polyethylene films and the two grades of cellulose films tested were found to be susceptible to insect penetration. In general, the results of the two series of tests were similar. *R. dominica* adults penetrated through most of the test films. Polyethylene films of 500 and 600 gauge offered resistance to penetration by all the test weevils. Cellulose films in contrast to polyethylene showed marked difference in their response to the relative humidity changes. At higher humidities the susceptibility to the penetration by weevils was considerably increased and was penetrated even by *O. surinamensis* adults, which normally acted as a very weak borer for the test films. This is probably due to the loss of toughness of cellulose films due to absorption of moisture at high humidities. The results obtained in these trials indicated that *R. dominica* was most destructive to polyethylene

and cellulose films out of the four species tested for insect penetration.

The studies on the insect penetration of cellulose and polyethylene have been extended to the larvae of the moths as at this life stage they are capable of boring through materials. Studies on the relative insect resistance of non-transparent and transparent laminates, aluminium foils, and a variety of papers are in progress.

Summary

1. The insect resistance of polyethylene and cellulose films was tested by two methods using four species of insects, namely, *Tribolium castaneum*, *Sitophilus oryzae*, *Rhizopertha dominica* and *Oryzaephilus surinamensis* under four different conditions of temperature and humidity.

2. An improved method to find out the insect resistance of packaging films has been described.

3. Cellulose films (both plain and moisture proof) was readily penetrated by the species of insects tested.

4. The resistance of polyethylene film to insect penetration varies directly with film thickness. Polyethylene films of above 400 gauge are quite resistant to the four species of insects.

5. Of the insects tested *Rhizopertha dominica* is the most destructive and *Oryzaephilus surinamensis* is the one least able to penetrate the films.

6. The susceptibility of the films to insect penetration at higher humidities was greater than at lower humidity.

Acknowledgment

The authors are deeply indebted to Dr V. Subrahmanyam, Director of the Institute for his active support and sustained interest during these studies.

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EFFECT OF PREHARVEST FOLIAR SPRAYS OF MALEIC HYDRAZIDE ON THE COLD STORAGE BEHAVIOUR OF ONIONS AND GARLIC

The use of maleic hydrazide (MH-40) as a growth depressant is being tried on an increasing scale. The most obvious benefit obtained by the use of this chemical as a preharvest spray material is the inhibition of sprouting in stored onions. The dosages used by American workers¹ were very much higher (upto 3000 p.p.m.). Mathur *et al.*² reported that the inhibitory effect of a preharvest spray of maleic hydrazide on rooting and sprouting was more pronounced at a higher temperature of storage than at a lower one. The concentration of the active ingredient in the spray solutions used by them varied between 200 and 600 p.p.m. The present investigation was undertaken to study the effects of higher concentrations (750 to 1500 p.p.m.) on the cold storage behaviour of onions and garlic.

Locally available varieties of onions (Mysore pink) and garlic were planted in the fields. The plots were marked out in such a way that the number of plants per plot was between 40-50 in the case of onions and between 90-100 in the

case of garlic. Each such plot was sprayed with 300 ml. solution of MH-40 in concentration of 750, 1000 and 1500 p.p.m. (of active ingredient). The plots were randomized in respect of different treatments. There were two replications for each treatment along with two plots as control.

The plants were sprayed six weeks before harvest of both the crops. Onions and garlic were lifted, cleaned, and were left at room temperature for curing for a week. Samples of equal size were then stored in a cold storage chamber maintained at 32-35° F and R.H. of 80-90 per cent. During the storage period, rooting and sprouting were observed periodically and respiration measurements were done at specified intervals on single bulbs by the continuous current method, the CO₂ evolved being absorbed in 0.1N. Ba(OH)₂ which was subsequently back titrated against 0.1N. HCl. The data obtained are given in Tables I-II and Figs. 1 and 2.

It will be seen from the results presented here that higher dosages of MH-40 have not shown

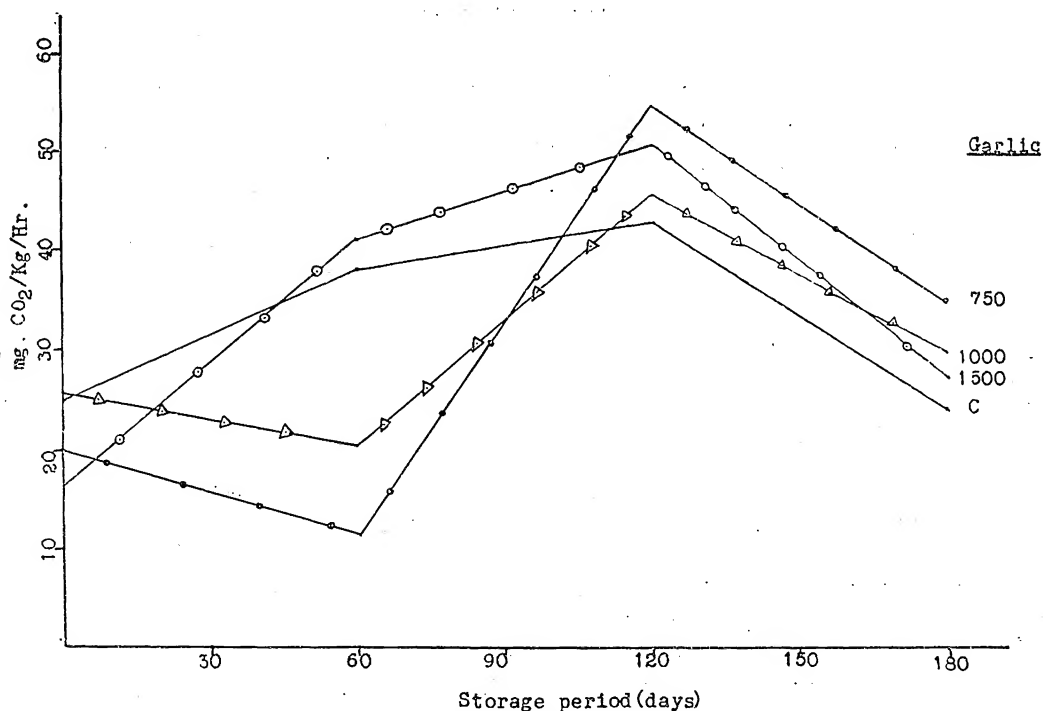


FIG. 1. Respiration rate of onions and garlic treated with MH-40 and stored at 32-35°F & R. H. 80-90%.

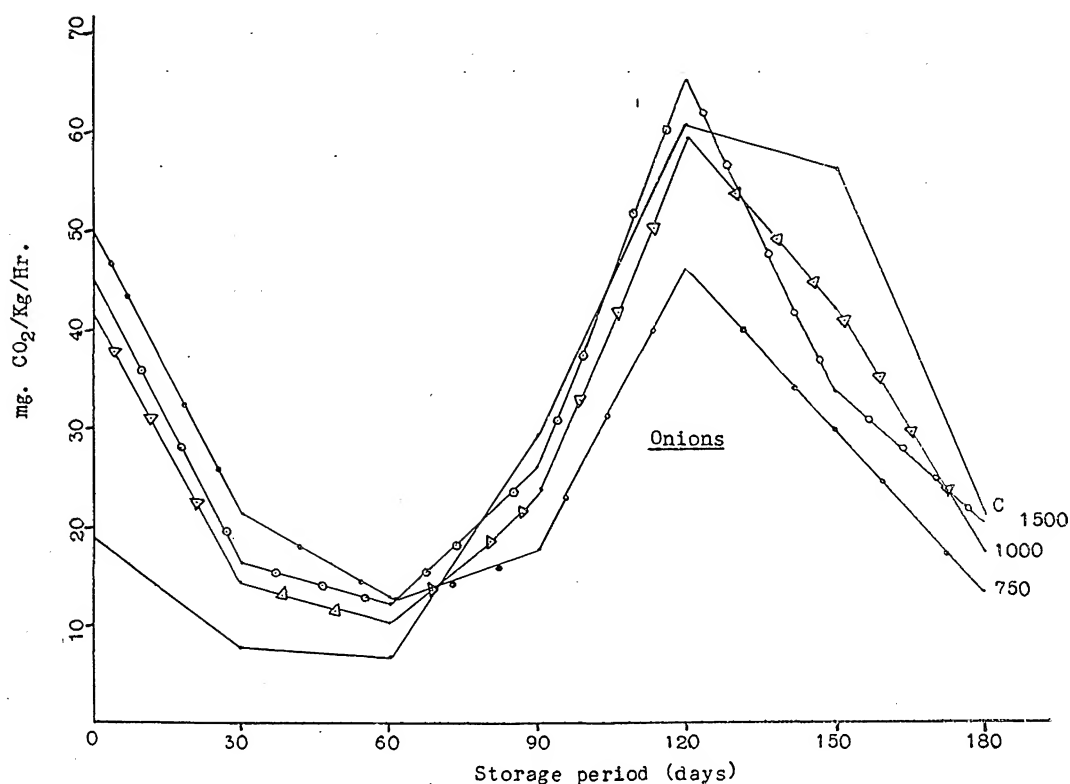


FIG. 2. Respiration rate of onions and garlic treated with MH-40 and stored at 32-35°F & R. H. 80-90%.

TABLE I. Percentages of rooted (R) and sprouted (S) onions treated with MH-40 and stored at 32-35°F and R.H. 80-90%

	30		60		90		120		150		180	
	R.	S.	R.	S.	R.	S.	R.	S.	R.	S.	R.	S.
1. No treatment	100	5	100	27	100	57	100	70	100	92
2. MH-40 750 p.p.m.	100	7	100	9	100	20	100	32	100	64
3. " 1000 p.p.m.	100	5	100	8	100	28	100	44	100	64
4. " 1500 p.p.m.	100	7	100	16	100	28	100	44	100	60

TABLE II. Percentages of rooted (R) and sprouted (S) garlic treated with MH-40 and stored at 32-35°F and R.H. 80-90%

	30		60		90		120		150		180	
	R.	S.	R.	S.	R.	S.	R.	S.	R.	S.	R.	S.
1. No treatment											...	55
2. MH-40 750 p.p.m.	There was no		rooting or sprouting		during		5 months of		storage		...	45
...											41	
...											40	
3. " 1000 p.p.m.											...	45
4. " 1500 p.p.m.											...	40

much depressant action on the respiration rate of onions and garlic stored at 32-35°F. In respect of rooting and sprouting, however, some differences were shown. In the case of garlic there was no rooting at all during the entire storage period while in the case of onions there was 100 per cent rooting within first two months of storage in all the lots. Thus, even the higher dosages of MH-40 used in these trials have shown

mild stimulant effects similar to smaller dosages employed by Mathur *et al.*²

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W. B. DATE

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CHEMICAL COMPOSITION AND NUTRITIVE VALUE OF JOWAR (KAFFIR CORN—*Sorghum vulgare*) AND JOWAR DIETS

By P. P. KURIEN, M. NARAYANA RAO, M. SWAMINATHAN AND V. SUBRAHMANYAN

(Central Food Technological Research Institute, Mysore)

Jowar (Kaffir corn—*Sorghum vulgare*) is widely cultivated in several countries—notably in Africa, China, India and the Americas. The area under *jowar* in India during 1957-58 has been estimated at 40 million acres and the annual production at about 8 million tons¹. More than 80 per cent of the production is confined to the states of Bombay, Andhra, Mysore, Madras and Madhya Pradesh. Figures for the production of *jowar* in the various countries in the world² and in different states in India¹ are given in Tables I and II.

TABLE I. *World production of jowar, 1957*
(1000 metric tons)

EUROPE	...	...	...	40
Hungary	...	...	...	5
Yugoslavia	...	...	...	30
AMERICA	...	...	...	14,560
United States	...	...	14,334	
El Salvador	...	...	134*	
Honduras	...	...	52*	
Argentina	...	...	46	
ASIA	...	...	...	8,560
India	...	...	8,056	
Pakistan	...	...	176	
AFRICA	...	...	...	2,500
Ethiopia	...	...	43	
Sudan	...	...	1,097	
Union of South Africa	...	...	198	
Egyptian Provinces	...	...	566	
AUSTRALIA	...	...	...	90
OTHER COUNTRIES	...	...	...	50
World total excluding U.S.S.R.				25,800

* Figures for production during 1956.

Jowar is generally grown as a dry (rain fed) crop though in certain areas it is also cultivated to a limited extent as an irrigated crop³. Under rain fed conditions, the average yield of *jowar* per acre ranges from 700-800 lb. while under irrigated conditions a higher yield of 1500-2500 lb. can be obtained. *Jowar* is consumed as a staple food by millions of people in several states in India. The working classes generally prefer *jowar* to softer grains like rice, because of

TABLE II. *Annual production of jowar (1957-58) in different states in India*

State	Area under cultivation (1000 acres)	Production (1000 tons)
Mysore	6,359	1,031
Madras	1,870	484
Bombay	17,238	3,276
Andhra Pradesh	6,180	1,178
Madhya Pradesh	4,260	1,168
Uttar Pradesh	2,104	490
Rajasthan	2,591	313
Delhi	29	4
Punjab	748	106
Bihar	5	1
Other States	27	5
Total	41,411	8,056

its cheapness and sustaining qualities. The grain is generally consumed after being ground into flour. The flour is usually consumed in the form of unleavened bread, dumpling or pancakes.

Chemical composition of jowar

Jowar varies in colour from red, dark brown to nearly white depending on the variety. The chemical composition of different varieties of *jowar* has been studied by different groups of workers⁴⁻⁵. The results (Table III) have shown that there is a fairly wide variation in the chemical composition due to variety. It is evident from the results that *jowar* is a richer source of protein than rice or *ragi*. It is also a fair source of some B-complex vitamins.

Proteins: Sur *et al.*⁴ analysed different varieties of *jowar* for their protein contents and reported values ranging from 9.7 to 10.3 per cent. The principal protein of *jowar* is a prolamine named kafirin, which accounts for more than 50 per cent of the total proteins⁶. Dowel and Manual⁷ observed that all the proteins in *jowar* could be extracted with dilute alkali and can be precipitated by acetic acid.

Amino acid composition of jowar proteins: The amino acid composition of the proteins of *jowar*



TABLE III. Chemical composition of different varieties of jowar (*Sorghum vulgare*)

Strain	Moisture %	Protein (N \times 6.25) %	Fat %	Ash %	Calcium (mg. %)	Phosphorus (mg. %)	Iron (mg. %)	Thiamine (mg. %)
2	10.4	10.04	2.8	1.87	90.8	204.0	2.6	0.30
3	12.3	9.73	3.05	1.66	55.2	196.6	2.3	0.28
0012	12.9	9.94	2.90	1.59	66.5	185.0	2.5	0.33
0018	13.0	10.05	2.89	1.87	51.4	172.1	2.0	0.28
0019	11.6	10.06	3.18	1.57	75.6	164.4	1.1	0.28
0051	10.5	10.29	2.82	1.81	127.3	167.1	1.4	0.32
Local bazaar sample	9.6	9.80	3.04	1.62	145.1	345.4	7.5	0.35

has been studied by several workers both by chemical and microbiological assay methods^{8, 9, 10}. The essential amino acid make-up of the proteins of a few varieties of *jowar* is given in Table IV. These figures indicate that *jowar* proteins are good sources of all the essential amino acids except lysine and threonine. As in the case of corn¹¹ there is an imbalance between leucine and isoleucine.

TABLE IV. Amino acid composition of different varieties of *jowar*

(Values expressed for 16.0 g. nitrogen)

	Market sample	CO:4	CO:5	CO:7
Arginine	6.6	5.6	6.2	7.0
Histidine	1.4	1.5	1.4	1.8
Isoleucine	4.8	6.0	6.6	7.0
Leucine	10.7	13.2	14.1	14.4
Lysine	2.8	3.4	3.9	2.8
Methionine	1.7	1.5	1.6	1.8
Phenylalanine	4.5	5.0	5.4	5.9
Threonine	3.9	3.4	3.6	4.5
Tryptophan	1.2	1.2	1.3	1.03
Valine	6.2	5.6	6.1	5.2

Carbohydrates: *Jowar* contains 65-75 per cent of carbohydrates of which starch is the main constituent. Baird and Francis¹² reported that

starch alone accounts for 58.9 per cent of the grain. Kurien *et al.*¹³ reported similar values for the starch content of *jowar*. The presence of pentosans and reducing and non-reducing sugars in *jowar* was reported by Baird and Francis¹². A variety of sorghum called sweet sorghum widely cultivated in U.S.A. was reported to contain 10-13 per cent of sucrose. Surjit Singh *et al.*¹⁴ reported that *jowar* starch unlike other cereal starches contained more of amylopectin than amylose. The starch present in waxy *jowar* has been reported to consist mainly of amylopectin¹⁵. Sur *et al.*¹⁶ studied the *in vitro* digestibility of the raw and cooked starch from *jowar* by salivary amylase and found that the rate of digestion of *jowar* starch was similar to that of other cereal starches.

Minerals: Baird and Francis¹² analysed different varieties of *jowar* and reported figures ranging from 51-145 mg. per cent for the calcium content. Sur *et al.*⁴ reported that the mineral content of different varieties of *jowar* varied from 1.59-1.87 per cent. The phosphorus content of *jowar* was of the same order as that of other cereals and ranged from 104 to 345 mg. per 100 g. in different samples. The iron content of *jowar* varied from 1-3 mg. per 100g. Sundararajan¹⁷ and Giri¹⁸ reported that more than 75 per cent of the total phosphorus in *jowar* is present in the form of phytin phosphorus. The presence of other minerals like sulphur, magnesium, sodium and potassium in the ash from *jowar* has been reported by Baird and Francis¹².

Vitamins: Banerjee *et al.*¹⁹ analysed seven varieties of *jowar* for thiamine content and reported that the values varied from 1.5–2.6 μg . per gram. Sur *et al.*⁴ reported values ranging from 2.8–3.5 μg per gram for the thiamine content. Chitre *et al.*²⁰ studied the thiamine, riboflavin and nicotinic acid contents of different strains of *jowar*. Their results showed that *jowar* is a fair source of the different B-complex vitamins. The above workers have also studied the effect of storage on the vitamin content of the grain and reported that there was no loss of thiamine and nicotinic acid in *jowar* during storage. There was, however, a slight increase in the riboflavin content of the grain during storage.

Distribution of protein, calcium and phosphorus in the husk and endosperm of *jowar*

Kurien *et al.*²¹ studied the distribution of protein, calcium and phosphorus in the husk and endosperm of *jowar*. The husk and endosperm of *jowar* were separated by soaking the whole grain for 48 hours in water containing 0.05 per cent of metabisulphite, grinding and separating the husk on a 100 mesh sieve. The husk accounted for 10.8 per cent by weight of the grain. The germ was separated from the husk, by suspending it in water and adjusting the specific gravity when the germ comes to the top and is removed by a fine sieve. The protein, calcium and phosphorus contents of the husk and endosperm of *jowar* are given in Table V. The results show that the husk contained 16.9 per cent of the total protein, 20.4 per cent of the total calcium and 11.1 per cent of the total phosphorus of the whole grain.

Digestibility and biological value of the proteins of *jowar*

The digestibility and biological value of the proteins of *jowar* have been studied by a large number of workers. Swaminathan²² reported values of 83 per cent and 91 per cent for the biological value and digestibility co-efficient of the proteins of *jowar* when fed to adult rats at 5 per cent level. The same author studied the protein efficiency ratio of *jowar* proteins at 5 per cent level of protein intake and reported a value of 0.78 only²³. Phansalkar and Ramachandran²⁴ reported a value of 1.61 for the protein efficiency ratio of *jowar* proteins at 10 per cent level of protein intake. Sur *et al.*²⁵ found a protein efficiency ratio of 1.2 at 8 per cent level of protein intake. Parching of *jowar* has been reported to result in an increase in the biological value and digestibility of *jowar* proteins²⁶. The proteins of certain pulses have been reported to supplement those of *jowar* to a significant extent²⁴.

Availability of calcium and phosphorus in *jowar*

The calcium content of *jowar* is of the same order as those of wheat and *bajra* but much less than that of *ragi* (*Eleusine coracana*). Giri¹⁷ and Sundararajan¹⁸ reported that about 80 per cent of phosphorus in *jowar* is present as phytate phosphorus which is not readily available for animal and human nutrition. Giri²⁷ found that about 84 per cent of calcium and 67 per cent of phosphorus in *jowar* was retained by rats. He also found that the availability of calcium and phosphorus from *jowar* was comparable to that of other millets like *ragi* (*Eleusine coracana*) and *bajra* (*Pennisetum typhoideum*) when fed at the same level of calcium or phosphorus intake. Ranganathan²⁸ reported

TABLE V. Protein, calcium and phosphorus contents of the husk and endosperm of *jowar*

Component	Component as percentage of whole grain (%)	Protein		Calcium (mg.)		Phosphorus (mg.)	
		%	as percentage of total protein	%	as percentage of total calcium	%	as percentage of total phosphorus
Whole grain ... ..	...	7.7	...	37	...	245	...
Husk	10.8	12.03	16.9	69.9	20.4	252	11.1
Endosperm	84.2	5.27	56.4	16.1	36.2	84.5	29.1
Dried solids from the supernatant	3.2	62.9	26.1	493.9	42.7	4495	58.7

that 70.4 per cent of the ingested calcium and 55.5 per cent of the ingested phosphorus from *jowar* was retained by the albino rat.

Effect of milling on the nutritive value of jowar

Narayana Rao *et al.*²⁹ studied the effect of milling on the chemical composition and nutritive value of *jowar*. Milling of *jowar* resulted in a loss of 20 per cent of protein, 50 per cent of minerals and 33 per cent of thiamine in the whole grain. Both *ad lib* feeding and paired feeding experiments showed that a poor vegetarian diet based on unpolished *jowar* promoted a significantly higher growth in rats than a similar diet based on polished *jowar*. Rats fed on unpolished *jowar* diet retained significantly larger amounts of nitrogen and phosphorus than those fed on polished *jowar* diet. The retention of calcium on polished and unpolished *jowar* diets were nearly the same.

Nutritive value of poor jowar diets

The nutritive value of a poor vegetarian diet based on *jowar* has been studied by several workers by growth experiments on rats^{29, 30}. The results indicate that the growth promoting value of a diet based on *jowar* is higher than that of a similar diet based on rice; the average weekly increase in body weight of rats ranging from 6-9 g. on *jowar* diet as compared to 4-6 g. on rice diet. Kurien *et al.*¹³ studied the effect of partial or complete replacement of rice by *jowar* in poor vegetarian diets on the growth and composition of the liver and blood of rats. The results (Table VI) showed that substitution of rice in a

TABLE VI. Effect of partial or complete replacement of rice by *jowar* in vegetarian diets on the growth and haemoglobin content of rats

(Duration of experiment: 8 weeks)

Percentage of rice and jowar in the diet		Average weekly gain in body weight (g)	Haemoglobin g/100cc.
Rice ...	78.5	5.68	14.79
Rice ...	58.9	6.62	15.25
Jowar ...	19.6		
Rice ...	39.2	6.35	15.14
Jowar ...	39.3		
Jowar ...	78.5	6.47	15.55

poor rice diet either partially (25 or 50 per cent) or completely by *jowar* did not affect to any significant extent the overall nutritive value of the diet as judged by the growth of rats. There was no significant difference in the haemoglobin and red blood cell count of the blood or in the average fat content of the livers of different groups of animals fed diets containing different levels of rice and/or *jowar*. The results obtained by these workers indicate that rice in Indian diets can be replaced partially or completely by *jowar* without affecting the overall nutritive value of the diet. Sur *et al.*⁴ showed that diets containing *jowar* as the only source of protein, B-complex vitamins and minerals, were inferior to similar diets based on wheat.

Venkatarao *et al.*³² reported that low fat groundnut flour when incorporated at 10-20 per cent level in the diet, produced a significant improvement in the growth promoting value of the diets. Kuppaswamy *et al.*³³ found that Indian multi-purpose food incorporated at 12.5 per cent level in a poor *jowar* diet, exerted a marked increase in the growth promoting value of the diet.

Metabolism of nitrogen, calcium and phosphorus in children on jowar diet

Kurien *et al.*³⁴ studied the metabolism of nitrogen, calcium and phosphorus in children fed on a poor diet based on *jowar*. All the subjects were in positive nitrogen, calcium and phosphorus balance. The apparent digestibility of the proteins was only 55.4 per cent. The same workers reported that partial or complete replacement of rice by *jowar* in a poor Indian diet caused a decrease in the retention of nitrogen and calcium and an increase in the retention of phosphorus in children³⁵. The results are given in Table VII.

Utilisation of jowar for the production of malt, malt extract and malt foods

Jowar is a suitable raw material for the production of malt and malt extract. The grain is extensively used in U.S.A., China and other places for this purpose. The diastase activity of *jowar* malt is, however, less than that of barley malt. Malt extract prepared from *jowar* conformed to the B.P. standard and possessed a good taste³⁵.

TABLE VII. Mean daily intake and balance of nitrogen, calcium and phosphorus in children on rice and jowar diets

Diet No.	Quantity of rice and jowar in the diet (g.)	Nitrogen			Calcium		Phosphorus	
		Intake (g)	Balance (g)	Apparent digestibility %	Intake (mg.)	Balance (mg.)	Intake (mg.)	Balance (mg.)
A.	Rice ... 360	6.34	1.80	74.7	355	124	744	169
B.	Rice ... 270	6.42	1.55	69.3	381	109	835	204
	Jowar ... 90							
C.	Rice ... 180	6.50	1.28	63.7	410	97	928	233
	Jowar ... 180							
D.	Jowar ... 360	6.91	0.88	55.4	441	75	1091	310

The relative merits of *jowar* and *ragi* and certain other millets for malting were examined by Viswanath *et al.*³⁶ who reported that both *jowar* and *ragi* were well suited for malting. The amylases of *jowar* malt were studied by different workers^{37,38}. Ungerminated *jowar* has been reported to have very little of amylase activity. Germination led to a pronounced increase in the α -amylase activity of the grain^{37,38}. *Jowar* malt is a poor source of β -amylase.

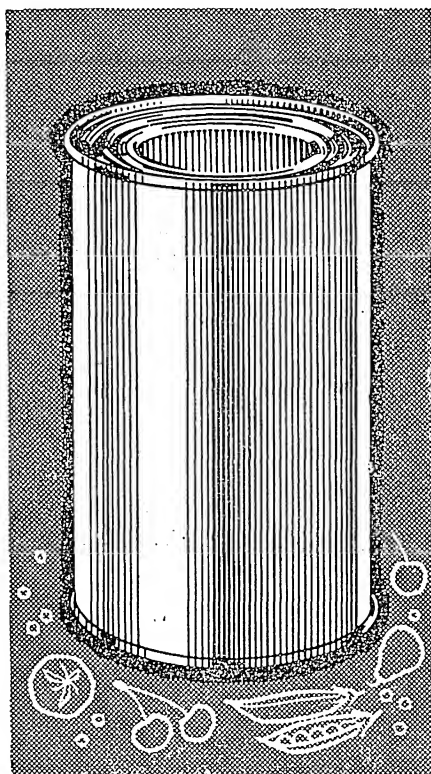
Chandrasekhara *et al.*³⁹ standardized the conditions for the preparation of a nutritionally balanced malt food by blending *jowar* malt flour with skim-milk powder, low fat groundnut flour, puffed Bengal gram flour and fortifying with different vitamins and minerals. The low cost malt food was found to compare favourably with whole milk powder in promoting the growth of rats and as a supplement to poor rice diet. The malt food was also found to be a good supplement to the diets of weaned children⁴⁰.

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Aiyars

Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during May 1960 are given in this section.

S (IS) 14

Some organic compounds in dried skim milk, by M. R. Chandrasekhara, (May 3, 1960).—Introducing the subject, the speaker said that the investigation was carried out in the Dairy Research Institute, New Zealand in collaboration with Dr E. L. Richards when the speaker was on deputation under Colombo Plan. The speaker gratefully acknowledged the contributions of Dr Richards in carrying out the work.

The general concept of non-enzymatic browning as elaborated by Hodge assumes the formation of N-substituted glycosyl amines which undergo Amadori rearrangement giving rise to N-substituted-1-deoxy-1-amino 2-ketoses (fructosyl amines) and these undergo dehydration or fragmentation giving rise to hydroxymethyl furfural, reductones, glyceraldehyde and other carbinols and acids.

The speaker then described the methods followed for the separation and identification of the organic compounds in browned skim milk powder (stored for 21 days at 55° C over a R.H. of 70 per cent). Column chromatography had been used for separating the sugar epimers, while paper chromatography was used for separation and identification of carbinols and acids. The compounds identified are lactose, lactulose, galactose, tagatose, glyceraldehyde, acetaldehyde, acetone, lactic acid, glycollic acid, citric acid, formic acid, acetic acid, butyric acid and maltol. The last mentioned compound has been reported by earlier workers to be present in autoclaved milk. Patton and co-workers, have also shown that it is formed when casein and lactose are subjected to browning.

While the carbinols and the acids could be formed by the already accepted mechanism of browning, i.e., by the sugar-amino acid combination, the presence of sugar epimers like lactulose and tagatose cannot be accounted for by this mechanism. Corbatt and Kenner have shown that when lactose is subjected to alkaline degradation, it epimerizes into lactulose and tagatose. A similar mechanism has apparently been operating in this case also. Lactose under the catalytic effect of the free amino groups has epimerized to lactulose which has given rise to galactose and trioses. Galactose has further epimerized to tagatose and this in turn has broken down to trioses. While the presence of maltol shows that the sugar-amino acid combination has certainly taken place, the presence of sugar epimers indicates that part of the mechanism of browning has been by alkaline degradation of lactose, giving rise to trioses which combine with amino acids resulting finally in brown substances.

The discussion covered points relating to the role of amino group in the formation of the browning substances, effect of pH on browning, whether NH_3 can replace the amino groups in causing browning, effect of higher temperatures on browning, whether the same type of browning mechanism is observed in fluid milk, type of reactions that would take place if the milk powder is stored in the absence of humidity, quantities of the final products of browning, whether the browning products have any antimicrobial action, steps to be taken for the prevention of browning, effect of O_2 on browning, role of fat in browning, different stages during browning at which the various

compounds are formed, the nature of results that would be obtained if the components responsible for browning are added to model systems, etc.

Commending the investigation as an important piece of work, the President said that the ultimate aim should be to see to what extent the browning could be minimised during storage. The mechanism of browning is still not fully understood. Food products stored for long periods under the most optimum conditions do show discolouration and loss in nutritive value. He concluded by saying that we should analyse fully the causes for browning and identify the components responsible for discolouration.

S (IS) 15

Canning of drinking water, by G. S. Siddappa and A. M. Nanjundaswamy (May 9, 1960).—Introducing the subject, Dr G. S. Siddappa referred to the origin of the investigation and gave a brief account of the work done and the results obtained. Mr A. M. Nanjundaswamy followed up with a detailed presentation of the data.

Canned drinking water is an essential article in the emergency ration of Air and Naval Forces. There is an urgent need for packing this commodity for the Indian Defence Forces.

Although the process of canning drinking water appears to be quite simple, there are several technical difficulties such as internal rusting of the can, deposition of sediment, development of off-flavours, etc., which are difficult to control. In addition to this, the stringent A.S.C. specifications laid down by the Quarter-Master General, for this

commodity, make the problem still more difficult.

Analysis of the Cauvery river water, Municipal tap water and Laboratory tap water and also distilled and demineralised waters, showed that the chemical constituents of these waters were well within the limits, except for the slightly high chloride content in the case of Cauvery, municipal tap and laboratory tap waters, which may be considered as characteristic of the Cauvery water flowing through the strata in the region and not as due to any contamination or pollution.

Preliminary canning trials showed that internal rusting in plain cans was more intense and rapid in the case of distilled and demineralised waters than in the case of the municipal and laboratory tap waters. In the case of lacquered cans also, there was slight rusting along the side seams, which is by far the most active seat of corrosion, especially in a lacquered can. Further, the canned water had a characteristic resinous taste and odour. In order to minimise internal rusting, several treatments such as effect of wax-coating, strip lacquering, chromate treatment, etc., were tried, but with limited success only.

In the case of internal wax-coating of the cans, the water was slightly turbid with internal rusting of the can and had a peculiar taste. Strip lacquering was not quite effective in preventing internal rusting in the case of plain cans. In the case of Z-lacquered cans, however, there was very little internal rusting, but the resinous taste persisted. Even chromate treatment of the cans was not useful in preventing completely internal rusting, although the treatment kept the interior of the cans bright.

The next series of experiments were designed to study the effect of the composition of the water itself in relation to its canning quality. Dilute buffer solutions, in the pH range of 4 to 8, were canned and examined. Visible rusting was observed in all the cans where the pH was in the range of 6 to 8 and the water was also

slightly turbid, with a few tiny rust particles floating. In the pH range 5.0 to 5.5, however, there was no visible rusting, although on analysis, the water was found to contain traces of iron in solution. Salts such as NaCl, CaCl_2 , Na_2HPO_4 , sodium silicate, sodium hexa-meta-phosphate, Na_2CO_3 , NaHCO_3 and citric acid were added to the water at the rate of 100 to 500 p.p.m., both individually and in combination, to study their effect on internal rusting of the cans. It was found that in the case of (1) citric acid and (2) Na_2CO_3 and NaHCO_3 in combination only, there was no visible rusting. Based on this observation, systematic trials were carried out to develop two types of canned drinking water, namely, acid water and alkaline water.

Acid water: Municipal tap water was filtered in a Seitz filter and treated with 0.015 per cent to 0.025 per cent citric acid and then canned. On cut-out examination of the cans, visible rusting to varying extent was observed in all the cans, except in the case of water containing 0.02 per cent added citric acid. The iron content also was the minimum at that concentration, the pH being in the range of 5.3—5.5. The oxygen absorption value was, however, quite high. The soluble iron content was only slightly more than the prescribed A.S.C. limit. The taste was slightly metallic. The iron content of the water increased slightly during prolonged storage. The high oxygen absorption value was due to the added citric acid and not due to any pollution with decaying organic material.

Alkaline water: For alkaline treatment, both municipal tap water and distilled water were taken. A mixture of Na_2CO_3 and NaHCO_3 was used to raise the pH, since neither Na_2CO_3 nor NaHCO_3 by itself was satisfactory to prevent rusting in the can. A mixture of these two salts at the rate of 60 p.p.m. each gave satisfactory results. In the case of municipal tap water, the canned water was turbid with

a white deposit at the bottom and a white film was observed on the inside surface of the can, when the adhering film of water evaporated. There was slight rusting also, especially at the side seam, during prolonged storage.

Distilled water treated with Na_2CO_3 and NaHCO_3 gave a satisfactory canned product. There was no internal rusting of the can. The iron content was negligible even at the end of one year's storage at elevated temperature. This sample satisfied almost all the A.S.C. specifications except for the high pH and a slight opalescence, both of which could be considered as minor defects only in an otherwise excellent product. Addition of other salts like phosphates, etc., to lower the pH and prevent the occurrence of this slight opalescence, resulted in internal rusting of the can. The alkaline pH of water is thus essential to prevent any internal rusting of the can.

In conclusion, it may be said that two types of waters, namely, acid water and alkaline water, can be employed for canning in plain cans, the canned product satisfying almost all the important specifications for such a product. There are, however, still one or two minor defects, such as a slight opalescence in the case of alkaline water and a slight metallic taste in the case of the acid water, which require to be rectified by further critical investigation. The possibility of using alternate containers like polyethylene bottles, aluminium cans, etc., has been explored in a preliminary way. In the case of the plastic containers the present limitations are the difficulty in heat-processing them under pressure, after filling the water, and the development of a peculiar flavour in the water. Further work is in progress to overcome these difficulties.

The points that arose during discussion related to the cause of opalescence in the canned water and the possibility of overcoming it by using electrolytic tin plate, method of cleaning of the cans and treatment of water prior to filling,

microbiological purity of the water employed for canning, effect of using distilled water, effect of processing time on internal rusting of the can, degree of rusting in the case of canned fruits and vegetables, possibility of packing ice in cheap insulated containers, using beer cans for canning water, electrodeposition of copper in the containers to prevent rusting, oligodynamic action of metals and its relation to long storage of the Ganges water in copper and brass vessels, the bacteriophage property of Ganges water, reduction of processing time and temperature to take care of coli-form organisms only, etc.

Dealing with the several questions raised, Dr Siddappa said that alternate type of containers in place of tin cans, and use of metal chelating compounds were being studied to prevent even the slight corrosion of the can and avoid any metallic taste in the water. Pressure processing of the cans was essential according to specification. Work was already in progress to further improve the quality of the canned water.

In his concluding remarks, the President complimented the authors for their clear exposition and their systematic approach to the subject. Referring to the reputed long keeping quality of the Ganges water, he said that it might be partly due to the fine colloidal silt present in it and partly to the oligodynamic action of the metals of the containers in which it was generally preserved. It, however, needs to be scientifically investigated. He stressed the need to develop cheap and safe methods, for storing water in bulk without any sterilization, for long periods and in good condition. Plastic containers were not useful at present to store water. He hoped that some type of cheap container, which did not impart any taste to the water, might be developed in the future.

S (IS) 16

Strained baby foods based on mango pulp, by Soma Korula and M. Narayana Rao (May 21, 1960).

—After reviewing briefly the available literature on the role of fruits in nutrition, Miss Korula gave in detail the results of different investigations carried out to evaluate the supplementary value of strained baby foods based on mango pulp added to milk diet and rice-milk diet.

The two strained baby foods used in the investigations are mango custard (canned) and mango custard (dried). Both these foods were prepared from a blend of strained mango pulp, skim milk powder, corn starch and sugar. Mango custard (canned) was prepared by cooking the above blend and canning it. Mango custard, (dry) was prepared by drying the above blend on a twin roller drier. Both the strained baby foods were analysed for the different constituents by the standard method. The analysis showed that both the products are very rich in β -carotene containing about 6,000—12,000 $\mu\text{g./100g.}$

Growth studies carried out on rats showed that supplementation of milk diet and rice-milk diet with 20 per cent of strained baby foods (on dry weight basis) resulted in a slight but significant improvement in the growth of rats. In the case of rice-milk diet, the ratio of rice to milk was 1:5 which is also the ratio of cereal to milk in a balanced diet recommended for weaned children. As both the strained baby foods contained small amounts of skim milk powder an equivalent amount of skim milk powder was added to the control diets.

After feeding for a period of 8 weeks, the haemoglobin content and the R.B.C. count of the blood of all the experimental animals were determined. The results showed that (i) the R.B.C. count and haemoglobin of the blood of rats fed on milk diet supplemented with mango custard was slightly (but not significantly) higher than that observed with the control group and (ii) the R.B.C. count of the blood of rats fed on rice-milk diet supplemented with mango custard was significantly higher than that in the

blood of rats receiving the control diet.

After the determination of haemoglobin and R.B.C. count, the animals were anaesthetized with sodium amytal. The livers were analysed for moisture, protein and fat according to the standard procedures. The results on statistical analysis showed that the fat content of the livers of animals receiving the strained baby foods was significantly lower than that of the animals fed on the control diets. No significant difference was observed either in moisture or protein content of the livers of the different groups of animals.

The carcass of the different animals was analysed for moisture, protein, fat and ash. The results on statistical analysis did not reveal any significant difference in moisture, fat, protein or ash content of the body of rats fed on the different diets. The retention of nitrogen, calcium and phosphorus in the animals fed on the different diets was determined by the body retention method. The amount of nitrogen, calcium and phosphorus actually retained in the body of the experimental rats was calculated by subtracting the average nitrogen, calcium and phosphorus content of a group of rats of 28 days of age which were litter mates of animals used in the above experiment from the final quantities of nitrogen, calcium and phosphorus present in the carcass. The results showed that supplementation of both milk diet and rice-milk diet with the strained baby foods had a beneficial effect on the retention of nitrogen, calcium and phosphorus in rats.

Dr Narayana Rao, speaking next, after discussing the significance of the results obtained, described in detail the investigations carried out to study the effect of supplementing the strained baby foods to milk diet on the nature of the gastric contents of the rats.

Oral feeding of the rats was considered preferable to feeding by means of a stomach tube, as the resulting nervous tension may affect the gastric secretions. The rats

were starved of food and water overnight and were given the diets which were readily consumed. 15 minutes and 30 minutes after feeding, the rats were anaesthetized and the stomachs were removed intact. By making a small incision in the stomach wall, the gastric contents were collected. The gastric contents were centrifuged to remove the solid particles and were analysed for free acidity, organic acidity and total acidity by titrating with N/100 alkali to pH 3.3, 6.0 and 8.5. A mixture of equal parts of Toepfer's reagent and phenolphthalein was used as the indicator. The results showed that the free acidity and organic acidity in the gastric contents of rats receiving the strained baby food was slightly more than that of the control group receiving the milk diet.

The peptic activity of the gastric contents were estimated by the method of Mett. The procedure followed was the same as that described by Hawk, Oser and Summerson. The peptic index was obtained by squaring the column of albumin digested and correcting for dilution. The results showed that the peptic activity of the gastric contents of the animals receiving the strained baby food was higher than that of the control rats receiving the milk diet.

The milk clot obtained in the case of the rats fed the control diet was hard and dense whereas that obtained in the case of rats receiving the strained baby food was semisolid. Histological sections of the clots taken confirmed the microscopic observation.

Summarising the seminar, Dr Narayana Rao said that supplementation of milk diet and rice-milk diet with strained baby foods based on mango pulp (i) has a beneficial effect on the growth promoting value of the diet and on the retention of calcium and phosphorus in rats, (ii) increased the total acidity of the gastric contents, (iii) increased the peptic activity of the gastric contents and (iv) helped in the formation of a softer curd in the stomach.

He also pointed out that these experiments will be extended to infants and weaned children and that the results so far obtained in the case of rats only give an indication of the results that can be expected in experiments on children.

Some of the salient points raised during the discussion related to the mode of administering the strained baby food—whether with the diet or spaced in between normal diets, quantity of strained baby food to be given to infants, provitamin A activity of the food, protein content of diets employed, nature of results that would be obtained with a product of high crude fibre content, effect of fibre on faecal bulk, higher utilization of Ca in rice-milk diet as compared to milk diet, reasons for higher growth rate on rice-milk diet as compared to milk diet, and how the higher increase in weight in the case of rats fed with supplementary diet is accounted for.

Answering the questions, Dr Narayana Rao said that the higher growth rate on rice-milk diet as compared to milk diet, observed

in the case of rats, may be due to the intestinal synthesis of amino acids and to the slower rate of digestion of the food with a resultant increase in the absorption of protein; but work needs to be done on these aspects. The higher increase in weight in the case of experimental rats fed on the supplemented diets is accounted by the increase in retention of nitrogen, calcium and phosphorus by the experimental rats. The faecal bulk is influenced by the hemicelluloses present in the diet. The higher percentage utilization of Ca in the case of rats fed the rice-milk diet may be due to the lower content of calcium in the diet (3 mg. of Ca/g. of diet) which is optimum for rat growth.

The President in his concluding remarks said that infant feeding experiments should be conducted instead of rat experiments. He said that the effect of incorporation of fibre on the utilization of the diet by the rat could be found out. The stressed the need for ascertaining the optimum quantity of the strained fruit product that should be given to infants as also whether it should be given with milk or separately. He felt that work needs to be done with different kinds of fruit pulps. The role of pectin present in the pulp should also be investigated. It was also necessary to find out whether the high amount of acidity present in the product could be tolerated by infants. Development of a composite food containing some quantity of fruit pulp which can be used as any other infant food needs to be done.

Chewer's favourite

**ASOKA SCENTED
BETELNUT POWDER**

Manufacturers: M. K. Krishna Chetty, Post Box No. 106, Coimbatore

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Wheat germ oil

E (IS) 46

We request you to furnish us with information regarding wheat germ oil, its production and uses. (Bombay).

Wheat germ contains about 10 per cent fat which can be extracted by using any of the fat solvents like diethyl ether, petroleum ether or alcohol. The wheat germ oil has the following percentages of fatty acids: Palmitic, 13.8; stearic, 1.0; oleic, 30.0; linolic, 44.1 and linolenic, 10.8. The oil is a fairly rich source of vitamin E containing as much as 0.178 per cent.

The oil is used for medicinal purposes and is of commercial interest mainly because of its vitamin content. We may, however, state here that the proportion of germ in wheat is about 2 per cent of the whole grain and only 0.2 per cent is recovered as such in ordinary processes of milling wheat into flour. The rest of the germ mostly goes along with the bran.

Activated carbon from rice husks

E (IS) 47

We have large quantity of rice husks available in our district and we are interested in industrial exploitation of this product. We are specially interested in the manufacture of activated carbon and insulation material. Would you be kind enough to send us the necessary information? (Kaira District).

The paddy husk is of little monetary value and is mostly utilised as a fuel. We have done some preliminary work on the preparation of activated carbon from paddy husk. For the preparation, the paddy husk is first ground so as to pass through a 40 mesh sieve. The

sieved material is first digested with sodium hydroxide and then activated with zinc chloride. The resulting activated carbon has got good bleaching properties comparable to some foreign carbons and bleaching earths.

As regards the preparation of insulation material from paddy husk, we have not done much work although it is known that paddy husk has more thermal conductivity. We have conducted some preliminary trials to make cushion boards or pads from paddy husk which can be used as a packaging material.

Composition of grapes

E (IS) 48

I shall deeply appreciate if you can kindly inform me the composition of Bangalore blue variety of grapes. (Bangalore).

The composition of the Bangalore blue variety of grapes is as follows:

Juice content	...	83%
Marc and seeds	...	17%
°Brix	...	12.5° at 20° C
Acid as tartaric acid	...	1.45%
Reducing sugar	...	9.46%
Total invert sugar	...	9.75%
Total tannin	...	90 mg./100 cc. in juice

Rancidity in ghee

E (IS) 49

It is common experience that ghee gets a peculiar bad odour after a period of a month or two. I am interested in knowing from you any cheap and easy method of deodorising the same. Sometimes, I have seen people using betel leaves for this purpose but however it does not work perfectly. (Bombay).

The spoilage of ghee during storage may be due to several factors such as unhygienic conditions of storage, traces of moisture, exposure to air and light and the use

of metallic vessels and porous earthenware for storage. Although hydrolytic rancidity leading to off-flavour is not so common in ghee as it is in butter, still tallowiness is commonly observed. The changes leading to tallowiness are brought about by oxidation usually by the oxygen of the atmosphere. Further, if the moisture content is high, fishiness shows itself. Another type of rancidity found in butter that is caused usually by the action of moulds is termed 'ketonic rancidity', the ketones that are formed during this type of spoilage being responsible for the strong odours. Besides these factors, the initial quality of ghee very largely influences its keeping quality.

To prevent ghee from undergoing any type of spoilage, it is necessary to see that the product is initially of good quality which is a result of taking sterilised milk, controlled souring, effective washing of butter and its immediate clarification into ghee at a low temperature. The ghee should be kept in a tinned vessel without any air gap and stored at as low a temperature as possible so that the sample is preserved well for a long time. The use of earthenware vessels for storing ghee has been shown to lead to quick deterioration and as such should never be used. If the ghee has to be preserved for a considerable length of time, it would be advisable to use antioxidants like ethyl gallate in suitable concentrations.

If the ghee is initially rancid, it can be refined by neutralization of the free acidity by instalments using sodium hydroxide of a calculated strength and quantity. The soap formed is thoroughly washed off by repeated additions of boiling water. The resulting ghee is entirely free from any off-flavour although it does



not regain the characteristic flavour of fresh *ghee*. It can, however, be marketed as low grade *ghee* or utilised for blending with higher grade *ghees*.

As regards the reference about the use of betel leaves for reclamation of rancid *ghee*, we have not done any work nor is there any published literature on this aspect. We presume that it is a traditional practice which needs scientific investigation.

Manufacture of cocoa from cocoa barrys

E (IS) 50

We intend to prepare cocoa ourselves from Ghana cocoa barrys. As such, will you please tell us how to roast the cocoa barrys and grind them to certain mesh fineness. Please furnish the details of the manufacturing process. (Tatanagar).

The raw cocoa beans are first cleaned so as to get rid of sand, dust, stones, metals and other foreign materials. The cleaned cocoa beans are then run into a roaster of the revolving drum type which is heated by coal fire using forced draft or by gas or superheated steam or electrically. The roast usually required 45 minutes depending upon the type of cocoa beans and the kind of roast desired. The final flavour of the cocoa powder and chocolate depends a great deal on the proper roasting of the cocoa beans.

The cocoa beans will attain a temperature from 240° to 300° F at the end of the roast and then are discharged quickly into a cooling truck with a perforated metal bottom, and are quickly cooled by sucking cold air through them.

The cooled beans are further cracked and shells are blown aside. The cocoa germs and fines are separated from the broken nibs by sieving them through rotating cylinder covered with screening of increasing mesh. The clean nibs are carried to a battery of triple stone mills and are ground into a heavy, viscous fluid known as chocolate liquor. This is the starting point in the manufacture of cocoa powder and chocolate.

In the manufacture of cocoa powder the chocolate liquor is transferred to hydraulic presses, and pressed from 8 minutes to 1½ hours, depending on the amount of fat that has to be left in the cocoa powder. The cocoa press cake is cooled, and broken up by cracking devices. Later on, it is passed over a magnetic belt to remove stray iron and then put through a micro-pulveriser. The ground press cake is then cooled and refined by sieving through a siling bolting cloth or by playing a current of air on the particles of cocoa in such a manner as to spread the fine cocoa from the coarse. The coarse cocoa or cocoa tailings, are returned to the grinders and reground over and over again until the particles are fine enough to pass through a sieve or can be separated by air flotation.

There are many kinds of cocoas, but they are divided into two main divisions, namely, (a) Natural process cocoa and (b) Dutch process cocoa.

Natural process cocoas are cocoas to which no alkalies have been added in the manufacture, while the Dutch process cocoas are cocoas to which an alkali has been added. In preparing Dutch cocoas, the clean nibs are boiled in a solution of alkali, such as potassium, sodium, ammonium bicarbonate, or carbonate. The water is evaporated and the nibs dried in a roaster. The nibs are milled, the liquor pressed and cocoa refined in the same manner as for Natural Process Cocoa. The Dutch Cocoa is darker in colour, less acid, and less bitter than natural cocoa.

Salting of string beans

E (IS) 51

We want to salt down string beans in local earthenware pots and shall be highly obliged if you can send the details of the same. (Bhuvaneswar).

For salting of beans, the initial concentration of the brine should be 40° salometer or approximately 10 per cent salt. A minimum concentration of 10 per cent salt should be maintained during the fermentation process to prevent the

growth of putrefactive organisms. On the other hand, if the concentration greatly exceeds 10 per cent salt, the activity of the lactic acid organisms is greatly reduced. During the first week of fermentation, it is customary to add salt to the container each day, draw off the brine from the bottom and pump it over the top until the brine is of uniform concentration throughout the container. If about one per cent of sugar is added to the brine, it greatly improves the character of fermentation. The fermentation and curing process normally requires from 4-6 weeks during which period the brine is maintained at about 10 per cent salt by adding salt to the top of the container and turning it over, to make the concentration uniform. Too frequent turning is considered undesirable as it will stimulate the growth of aerobic spoilage organisms. When fermentation is complete, the concentration of the brine is gradually increased and maintained at about 15 per cent salt (60° salometer).

Self-raising flour

E (IS) 52

We shall be thankful if you will kindly help us in obtaining the ingredients which are mixed into flour for making it a 'self-raising flour'. (New Delhi).

'Self-raising flour' is a flour incorporated with baking powder. In one of the formulas, baking powder consists of cream of tartar and sodium bicarbonate in the proportion of 2:1. This baking powder is added at the rate of ½-1 oz. per lb. of flour. We are also giving below a recipe for ready-made raising flour:

Soft flour	...	280 lb.
Ground rice or rice flour	...	10 "
Mixed baking powder		
(2:1) (cream of tartar	...	7 "
and sodium bicarbonate)		

Rice flour is incorporated in order to increase the short eating qualities of home made pastries. It is also incorporated as it assists in preventing the baking powder from getting lumpy or moist and so causing the powder to lose its strength through the inter-action of acid and alkali.

Notes and News

STATISTICAL NOTES

All-India Final Estimates of Rice, 1959-60

	1959-60 (Final Estimate)	1958-59 (Partially Revised Estimate)
Area (thousand acres) ...	81,343	81,437
Production (thousand tons) ...	29,338	30,354
<i>In Metric Units</i>		
Area (thousand hectares) ...	32,918	32,956
Production (thousand metric tons) ...	29,809	30,841

(Economic and Statistical Adviser, Ministry of Food and Agriculture, Government of India)

NEWS BRIEFS

Synergistic effects of antioxidants: Studies have been carried out to find the most suitable concentration of alpha tocopherol, the optimum amount of amino acids which should be used as synergists with respect to the use of alpha tocopherols and the effect of 16 alpha amino acids on the antioxidising properties of alpha tocopherol.

The activity of specific amino acids of a homologous structure was found to increase with the length of the chain and their anti-oxidising properties were also affected by the presence of a hydroxyl group. The best synergistic substances were found to be serine, isoleucine, alanine, kycine hydrochloride, tyrosine, phenylalanine, arginine hydrochloride, asparagine, glycine and glutamic acid. Cystine, valine, asparaginic acid, proline, and tryptophane promoted oxidation.

It was emphasised that the results were only of a practical and comparative character owing to metallic impurities and trace contamination of proteins and amino acids in lard as well as to the difficulties in evenly distributing the amino acids, which are poorly soluble in fat (*Food Manuf.*, January 1960, p. 32).

Ultrasonic extraction of vanillin: The amounts of vanillin, and of oleoresins, extracted from homogenised vanillin pods by ethanol are increased by exposure of the mixture to ultrasonic vibrations and

maximum extraction is obtained in a shorter time. The extent of extraction is increased with the intensity of the treatment and it was greater with an intermediate frequency than with those higher or lower. It was also proved to be greater with vanilla of 16 per cent moisture content than with that of 12.8 per cent content (*Food Manuf.*, January 1960, p. 33).

Special dispersion makes better dry gluten: Gluten was prepared formerly by employing high vacuum or time-consuming tray drying. An improved process, recently developed, overcomes stickiness and enables the raw product to be spray dried causing minimum damage to initial properties. In the new process, raw gluten from wheat starch operation is washed with water and the slurry is fed to agitator-equipped dispersion tanks where ammonium hydroxide is added to raise the pH to 9-10. The dispersed cream-like slurry is then spray dried to give high quality flour-like product that is bagged for shipments. The dried product (Midsol) has 83 per cent protein of high quality and is free from foreign odours, tastes and contaminating substances. Its texture is similar to flour or milk powder, and as such needs no grinding when used to upgrade second-grade flour. The dry gluten retains all its native properties and regains its original elasticity

on reconstitution with water. The remixed 'gum' cannot be distinguished from native material and readily forms a cohesive elastic mass. It is being commercially produced by a firm in the U.S.A. (*Food Engng.*, December 1959, p.73).

Ultrasonics seen as valuable aid in drying heat-sensitive foods: Conventional heating to take out the easily removed moisture, followed by ultrasonics to remove the remainder is seen as an improved method of drying heat-sensitive foods or ones that have long drying cycles.

Best suited for these operations are static sirens (airjet whistles). They are capable of producing intense, powerful acoustic emissions of over 1 kw., have no internal moving parts, are relatively inexpensive, and provide required flow turbulence. Efficiency is about 20 per cent.

However, these waves do not provide sufficient turbulence to carry moisture away rapidly. For this reason a partial vacuum or strong draft of air are necessary for satisfactory results. Extent of interface submitted to the waves is another factor governing rate of evaporation. Therefore, rotary or spray dryers give best results.

In the former, the slow turning motion provides a continuous renewal of product interface exposed to the sound. Spray dryers appear to be ideal for ultrasonic when emissions of 10-15 kc./sec. are employed. The finely atomized wet globules can be held in suspension longer by an acoustic field. And when the particles are vibrated by the sound waves their surfaces are exposed to more drying air.

Another factor is effect of the waves on agglomeration. With a large oscillation amplitude, the smaller globules agglomerate, and with a small amplitude the larger ones agglomerate. This leads to higher recovery rates and a change in size distribution of products at bottom of dryer (*Food Engng.*, December 1959, p. 73).

Cocoa fat adulteration detected by infra red: Infra red spectra of cacao butter and such fats as hazelnut oil, hydrogenated peanut oil, and butterfat are very similar in their contours.

There is some difference in shape of curves between 8.5-9.5 μ wavelength, but not enough to permit detection of mixtures of other fats with cacao butter or in various types of chocolate.

The trans-fatty acids have a band at 10.35 μ which can be used for estimating amount of trans-olefine fats with an accuracy of 1 per cent, or even 0.5 per cent in favourable cases. Pure cacao butter does not contain the transomers in appreciable amounts.

Additions of a hydrogenated foreign fat up to 5 per cent in cacao butter, and to the fat fractions of dark and milk chocolate are rapidly detected and quantitatively estimated (as elaidic acid), with an accuracy within 10-20 per cent (*Food Engng.*, January 1960, p. 87).

High-speed egg grading-packing line: A cartoning line that enables 2 workers to inspect and pack as many as 7,200 eggs/hr. has been developed by AMS researchers.

In operation, eggs are first examined for dirty or cracked shells as they pass along a lighted conveyor, then detector removes ones containing bloodspots.

Clear eggs move onto a line of scales where they are weighed and channelled to packaging units which automatically position them, small ends down. Properly aligned, the eggs are conveyed to vacuum transfer units that grasp them—6 at a time—lower them into awaiting cartons. The cartons are belt-positioned from an automatic dispenser (*Food Engng.*, January 1960, p. 87).

Preservation of fruit products by sodium sorbate and mild heat: A combination of sodium sorbate (0.05 per cent) and mild heat (120° F. for 5 min.) greatly increased the storage life of fresh apple cider, peach slices, and fruit salad with no appreciable flavour

change. In the presence of 0.05 per cent sodium sorbate, a heat treatment as mild as 100° F. for 5 minutes destroyed more than 50 per cent of the initial yeasts, moulds, and bacteria and increased the storage life to 14 days, at room temperature. At 120° F, there was a 99 per cent reduction in microbial counts and the storage life was increased to 25 days at 70° F. Similar results were obtained with the other fruit products (*Food Technol. Austr.*, January 1960, p. 54).

Citric acid prevents asparagus darkening: Studies at the Research Laboratories of the National Canners' Association have shown that the black discolouration of canned green asparagus, caused by the combination of rutin from the asparagus and iron from the can in the presence of air can be prevented by adding small amounts of citric acid to the brine.

The amount of citric acid required is too small to have any significant effect on the flavour or pH of the asparagus. It prevents the darkening by causing sufficient tin to dissolve from the can to form the yellow tin salt of rutin rather than the black iron salt.

The question still remains how much citric acid should be added to produce the desired effect without causing excessive can corrosion (*Food Technol. Austr.*, January 1960, p. 54).

New apple product: Jellyed applesauce, suitable for canning, has been developed by the Canada Department of Agriculture's Research Station at Summerland.

It is one of a series of products intended to use surplus dessert apples. Use of a special pectin permits a gel to be formed from sweetened applesauce containing not more than 30 per cent sugar. Fruit acid is added to the product to impart a good tart flavour to the low-acid dessert varieties used. Set is controlled by varying the proportions of pectin, sugar and acid. Red food colouring is added to give an attractive product for serving with turkey or chicken, and a

nutmeg-flavoured jelly is produced for ham and pork (*Canad. Food Ind.*, March 1960, p. 60).

New uses for malt flour in foods: The enzymatic capabilities of malt has been known and put to use for many centuries, but only now are research workers intensively probing the full potential of this versatile material for process and product improvement. As is well-known, malt is used principally as a source of both extractives and diastatic activity in brewing and as diastatic supplement, in distilling and baking, for converting starches to sugars prior to fermentation, and, of course, scientific knowledge continues to extend control of the enzymes developed during malting.

The expanding use of malt as a food ingredient is a prime object of current research at malt laboratories, and these studies are already revealing numerous potential uses. One in particular may prove highly significant: recent findings indicate that malt flour has a food preserving effect (it imparts oxidative stability) beyond that attributable to its antioxidant properties. Fats thus treated ultimately reach a peroxide level where one would expect them to be rancid, yet they are not. In contrast, fats stabilised with other antioxidants do smell rancid at these peroxide values. The substances in malt responsible for this effect have not as yet been determined, but indications are that they are reductones that will stabilise a large variety of foods. For example, potato crisps may be kept in excellent condition for over three months when malt preservative is surface-applied (*Food Trade Rev.*, December 1959, p. 26).

Paraffin coating of eggs: Organoleptically determined changes in 65 paraffin-coated eggs kept over 6 months at a temperature of 1.1° C. were compared with laboratory indices, thought to be the most suitable for evaluating the freshness of eggs, by measuring the air space, the pH of both the yolk and the white, the inorganic phosphorus

content of the white and the degree of luminescence of the white in the light of a quartz lamp. The amount of non-protein nitrogen was also determined, assuming that this would obviate the more complicated determinations of ammonia and amino acids. Some eggs, which showed an advance state of decomposition, were also examined micro-biologically.

The height of the air space, the pH of the white and the content of non-protein nitrogen and inorganic phosphorus proved to be good features in determining the freshness of eggs, the latter two being the best. Determination of the non-protein nitrogen may, it appears, eliminate the need to determine the ammonia and amino acids content in egg white.

The advanced decomposition of some of the eggs was due to the action of large amounts of micro-organisms found in the egg white (*Food Manuf.*, February 1960, p. 78).

Frozen meat dishes: As part of a research programme investigating the suitability for deep freezing of pre-cooked foods, the German Federal Research Institute for Domestic Science, Stuttgart, has carried out systematic experiments with different kinds of meat dishes.

The investigations showed that, in principle, meat dishes are well suited for deep freezing as the quality is not impaired by the freezing process. However, after prolonged storage at -18°C , the flavour is liable to be affected. This deterioration is rather more marked with fried 'dry' dishes than with stewed or braised dishes frozen in gravy. The quality of beef after three months is slightly better than that of pork, veal or mutton where rancidity may be encountered. Freezing at -40°C was not found to have any clear advantage over freezing at -18°C so that the latter temperature must be regarded as adequate. With certain quickly prepared dishes such as beef or veal steak, frying is preferable to grilling, and the preparation time should be

rather shorter than with freshly prepared meat. With underdone beefsteak it is advisable to adhere to a shorter maturing time prior to freezing, especially if the storage time is to exceed one month. Another decisive factor in preserving the quality of the meat is the application of suitable thawing methods.

Dishes frozen in gravy should be heated with the addition of a little water; 'dry' dishes should be thawed in the oven at a temperature of 200°C . (*Food Manuf.*, February 1960, p. 78).

Purification of starch syrups: Mineral compounds and coloured organic substances were removed from starch juices with 'native' ion exchangers and activated carbon. Converter juice, with pH 2.3, and an ash content of 0.25 per 100° Brix, was passed through a battery of four columns. Two of the columns were in regeneration.

Within 2 hr. the juice obtained became slightly turbid. It was heated to 45°C , with 0.5 per cent by weight of activated carbon, vacuum filtered through Schott's funnel and concentrated under vacuum to 83° Brix.

The analysis of the resulting syrup was as follows: ash—0.007 per cent per 100° Brix; and acidity 2.0 ml. of 1 N sodium hydroxide per 100 g. syrup. No trace of turbidity was noted during more than 2 years' storage and the syrup was colourless. Demineralisation without activated carbon was less effective (*Food Manuf.*, February 1960, p. 79).

NEW INDIAN STANDARDS

Refined sugar: Refined sugar is manufactured from any type of sugar in general by a process of purification, consisting broadly of affination, melting, chemical treatment, filtration, decolourization and subsequent recrystallization in vacuum pan, the treatment depending upon the nature of the initial material.

The Indian Standard Specification for Refined Sugar (IS: 1151-1958) prescribes physical and che-

mical requirements, methods of sampling, and tests for refined sugar. Technical suggestions and accumulated testing experience of the National Sugar Institute, Kanpur, have been taken into account while drawing up the specification (*ISI Bull.*, January—February 1960, p. 37).

DRAFT INDIAN STANDARDS

Edible starches and cereal products: Four draft specifications cover the following items of edible starches and food products:

(1) *Edible groundnut flour:* Groundnut flour can be used both for blended and processed foods. It is being used in the preparation of soup powders, 'Mysore flour' (75 per cent tapioca flour and 25 per cent groundnut flour), tapioca macaroni, low cost protein foods, malt foods and enriched biscuits.

The draft specification prescribes requirements and methods of test for particle size, fortification, moisture, fat, crude fibre, total protein, etc., and also includes details of sampling, packing and marking.

(2) *Rolled oats (Quick-cooking type):* Rolled oats are one of the commonly used breakfast foods. In its manufacture, cleaned oats are kiln-dried, dehulled and then separated into various size groups. These dehulled oats called groats, are treated with live steam at atmospheric pressure. This treatment inactivates the enzymes and partially cooks the groats, which are then flaked by passage between two rolls.

Rolled oats are of two types, ordinary and quick-cooking having different cooking characteristics. The latter type, covered by the draft specification is obtained by cutting the groats into pieces of desired size before treatment with live steam. The size of the cut groats and thickness of the flakes govern the cooking properties of the product.

The draft specification lays down requirements and methods of test for oats content, foreign matter, flakes powder, cooking time, mois-

ture, total crude protein, crude fibre, alcoholic acidity, etc.

(3) *Macaroni, spaghetti and vermicelli*: Macaroni, spaghetti and vermicelli belong to a class of food products generally known by the terminology 'macaroni products'. The Italians call them 'Pasta Alimentare' (Alimentary paste) while German terminology is 'Tigwaren' (paste goods). The Macaroni Industry is well developed in Italy, U.S.A., France, Switzerland and other Western countries. Although vermicelli (semia) has been known and produced in India for a long time, the production of macaroni and spaghetti is of recent origin in this country. The principal raw materials are wheat semolina (*suji*) or *maida* obtained preferably from hard wheat, such as durum; the minor ingredients, which may be added, are salt, milk powder, casein, gluten and protein-rich oilseed meals.

The manufacturing process for macaroni, spaghetti and vermicelli consists of making the dough from wheat semolina or flour, with or without other ingredients, with cold or lukewarm water, kneading it and then extruding it through an extrusion press fitted with a die of desired shape. The extruded product cut to a given length is then dried to a definite moisture content under controlled conditions of temperature and humidity. The dried product is suitably packed depending on the market requirements.

The draft specification prescribes general requirements, method of enrichment, and requirements and methods of test in respect of moisture, total ash, total protein, acidity, cooking tests, etc., of the material.

(4) *White bread*: White bread is prepared from a mixture of flour, water, salt and yeast or other fermentative medium. The flour and salt are sifted for homogeneous distribution and mixed with the flour and salt mixture. The whole mixture is then kneaded into a

pliable dough. The dough is then allowed to stand for a given period until the height of fermentation is reached. Thereafter the dough is cut into pieces of requisite weight and put into either moulds or made into conventional shapes and left for some length of time for raising (proving). After raising, the pieces are baked in an oven and maintained at a temperature between 205° to 232° C. Throughout the process, complete control over temperature and humidity is necessary for the desired raising.

The draft specification lays down the essential and optional ingredients of the material and its improvers. It also specifies general requirements and details of weight, sampling, packing and marking of the bread loaf (*ISI Bull.*, January-February 1960, p. 40).

FOREIGN PATENTS

2,912,334. *Special extraction process makes better instant tea*: Production of a powdered tea extract containing substantially all the flavour of the leaves from which it is made is the object of a Swiss process. Method comprises counter-current extraction of tea leaves for 10 min. with 6-15 times their weight of 140-210 F. water. Dilute extract is then stripped with steam to produce a concentrated aromatic fraction. Dilute extract is concentrated at 85-125 F. to about 50 per cent solids, aromatic fraction is added to it and the mixture impregnated with inert gas followed by spray drying to provide a powder with bulk density of 0.2 g./cc. (*Food Engng.*, January 1960, p. 89).

822,904. *Preserving and ripening*: Relates to a method of preserving or ripening vegetable products including fruit, wherein the products are placed in a closed, gas-tight vessel containing initially a predetermined mixture of gases including a predetermined concentration of oxygen, and the total pressure of the gases is so initially adjusted and thereafter maintained

as to preserve the products, or to produce a predetermined rate of ripening.—Patented by Felice Bonomi and Anr. (*Food Trade Rev.*, January 1960, p. 80).

824,731. *Roasting coffee*: Relates to a method for obtaining more aromatic substances and reducing roasting losses, according to which coffee beans are heated for a period at a low temperature under normal pressure before roasting, the water vapours generated during this period being drawn off, after which roasting is carried out under pressure, and at the end of the roasting period, a cooling agent is injected at a pressure which is higher than that in the roasting drum, so that the beans are at least partly cooled before the pressure is allowed to drop.—Patented by Willi Brandl (*Food Trade Rev.*, February 1960, p. 82).

822,243. *Wheat food products*: A process for the production of a wheat product of high protein and low starch content, having excellent nutritive and dietetic properties, comprises separating endosperm from bran and wheat germ, mixing the separated endosperm with water separating the starch containing water from the mixture, removing excess water from the endosperm residue, recombining the endosperm residue, with bran and wheat germ and blending the mixture until uniform.—Patented by Proto International Hygienic Food Co. (*Food Trade Rev.*, February 1960, p. 82.)

824,513. *Antioxidant compositions*: A method of preparing an antioxidant composition in solution form, comprises reacting a fatty monoglyceride with citric acid and dissolving the reaction product in a heated edible oil: preferably an oil-soluble antioxidant, most suitably one or both of butylated hydroxy-anisole and propylgallate, is added to the solution.—Patented by The Griffith Laboratories, Inc. (*Food Trade Rev.*, February 1960, p. 84).

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THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles, mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

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Development of the science of nutrition in Slovakia since 1945—BUCKO, A.	66
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Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Flavour restoration in mandarin orange concentrate with orange oil, by Pruthi J. S., Sathyanarayana Rao, N. S., and Girdhari Lal, *Indian Perfumer*, 1959, 3 (1), 1.—The natural flavour of orange juice, which is mostly due to the presence of volatile essential oil, is lost during the process of vacuum concentration. The results of experiment conducted to determine the optimum level of fortification of mandarin orange concentrate or reconstituted juice with freshly extracted orange peel oil have been presented and discussed in this paper. Flavour evaluation of fresh and reconstituted juices was done by a selected panel of judges according to Hedonic scale. The data thus obtained were statistically analysed. Results indicate that unlike Valencia orange juice concentrate, addition of orange peel oil to the reconstituted Coorg Mandarin orange juice is very essential. The optimum levels of fortification of oil to the reconstituted Mandarin orange juice and four-fold concentrate were 0.02 and 0.08 per cent v/v respectively. The addition of 'Palatone' at the rate of 100 p.p.m. did not significantly improve the flavour of the concentrate or the juice reconstituted therefrom.

Studies on the roasting of coffee, by Natarajan, C. P., *et al.*, *J. sci. industr. Res.*, 1960, 19 A (1), 32.—The roasting characteristics of arabica and robusta coffee have been investigated with special reference to the relation between finish-

ing temperature of roast, colour, swelling and breaking strength of beans and the chemical composition of the brew. The roasting characteristics of the two varieties have been found to be different, and colour development has been found to be proportional to finishing temperature and duration of roasting. A linear relation has been observed between the colour of roast coffee and swelling ratio of the beans; the latter is influenced more by the temperature of which roasting is done than by the duration of roasting. During roasting, the total solids content and colour of the brew from roasts increase with roasting up to a point beyond which they decrease; chlorogenic acid and total sugar also decrease during roasting but caffeine content remain almost constant. It has been observed that the degree to which coffee beans are roasted can be defined in terms of finishing temperature, colour, breaking strength and swelling ratio of the roast beans.

Studies on calcium fortification of rice, by Radhakrishnamurthy, R., Desikachar H. S. R. and Subrahmanyam, V., *J. sci. industr. Res.*, 1959, 18 C (12) 245.—The 'calcuring' process as a method of fortification of rice with calcium has been found to be uneconomical. Among other possible methods of fortification, spraying the rice with calcium acetate solution in the presence of sodium or ferric phosphate solution increases the reten-

tion of calcium to about 45 per cent. Further, steam treatment of the above samples increases the retention to about 70 per cent. A calcium-rich preparation containing 34 per cent calcium could be prepared from a mixture of calcium carbonate (85 per cent) and wheat flour (15 per cent) and mixed with the rice. Eighty per cent of the calcium thus added was retained in the cooked rice.

Changes in tin and iron content of some Indian canned fruits and vegetables during storage, by Siddappa, G. S. and Bhatia, B. S., *Indian Food Packer*, 1960, 14 (1), 8.—The changes in tin and iron content during prolonged storage at 24-30°C and at 37°C in the case of canned fruits like mangoes, orange segments, guava, banana, melon, pineapple, grape, sapota, custard apple and palmyrah, palm kernel and canned vegetables like potato, tomato, field bean, green chilli, curried jack fruit, etc., have been studied. The tin content rarely exceeds the limit of 143 p.p.m. even at the end of 2 years' storage at ordinary room temperature. The iron content also is very small and rarely exceeds 60 p.p.m., the majority of the values being in the range of 10-40 p.p.m. In the case of canned fruits stored continuously for a long time at 37°C, however, the tin content can be far in excess of the prescribed limit, but this occurs at the time when the cans are flippers or swells.

PART II (Indian)

ADULTERATION

Detection of synthetic essence of mustard in mustard oil, by Gupta, J. C., Atma Ram and Om

Prakash, *Res. & Ind.*, 5 (2), 36.—The characteristic pungent odour of mustard oil is due to the presence of allylisothiocyanate which is form-

ed as a result of hydrolysis of the glucoside, sinigrin occurring in the mustard seed. The hydrolysis is caused by a ferment, myrosinase

in presence of water and at a suitable temperature. Allyl isothiocyanate is also produced synthetically. Mustard oil is sometimes adulterated with the synthetic product. Methods of detection of the adulterant based on the presumption that hydrocyanic acid was present in the synthetic essence, gave negative results. In this paper, the AA report a dependable method of detection based on the physical and chemical properties of the natural essential oil of mustard and the synthetic essence. Natural essential oil obtained by steam distilling the mustard oil was analysed for specific gravity, refractive index and optical rotation and the values have been compared with those of the synthetic essence. Distinct variation is observed in the physical properties of the natural and synthetic essences. The phloroglucinol test further helps in clearly distinguishing the two, as the yellow stain of the reagent and allyl isothiocyanate gradually changed to pinkish colour in about 2-3 hr. in the case of synthetic essence while with the natural essence, the colour did not change even on keeping for a long time.

K.L.R.

Application of paper chromatography to differentiate ghee from other fats. II. Directly spotting fats on chromatogram, by Ramachandra, B. V. and Dastur, N. N., *Indian J. Dairy Sci.*, 1960, 13 (1), 29.—A paper chromatographic method was standardised for distinguishing different fats commonly used as adulterants for ghee. When 50 per cent solutions of fats were spotted on the chromatogram the movements of the fats were visible in ordinary light. It was possible to distinguish ghee adulterated with 10 per cent *vanaspati* and 5 per cent body fat from the genuine product. The advantages and limitations of the method are discussed.

ANALYTICAL

Implications in the analysis of curd (*dahi*) by Mitra, S. N., *et al.*,

J. & Proc. Inst. Chem., 1960, 32 (1), 3.—Estimation of fat and SNF in *dahi* (curd) is not always the same as in case of milk. Fat is best estimated in sour *dahi* by the Werner-Schmidt method, Gerber process not being suitable for the semi-solid consistency of the product. In sweetened *dahi* Roesse-Gottlieb procedure should be applied. A modified form of the ordinary Werner-Schmidt tube has been described for the fat extraction, with a siphoning arrangement which permits removal of the top ethereal layer without disturbing in any way the lower layer. This is more convenient than the conventional Roehrig tube. Determination of SNF is complicated by the fact that during the formation of *dahi* volatile substances, mainly acetic acid, may be formed. For very exact figure, the acidity may be neutralised with standard alkali prior to drying just as for sour or altered milk, and making a correction for the alkali added. For routine work, however, the total solids, could be determined with reasonable accuracy by simply drying a portion just as in case of milk. Amount of volatile acid formed in *dahi* is not, in general, considerable and usually does not exceed 0.2 per cent as acetic acid. It is much less in sweetened *dahi*. Evaporation of some water during preparation of *dahi* more than counterbalances this amount of volatile acid, and actually results in increase in the different constituents over those of the corresponding milk. Estimation of SNF of sweetened *dahi* involves separate estimation of the sucrose present.

BIOCHEMISTRY AND NUTRITION

Effect of tocopherol deficiency on certain tissue enzymes of the growing rat, by Srikantan, T. N. and Krishna Murti, C. R., *J. sci. industr. Res.*, 1960, 19 C (1), 1.—Young rats fed a tocopherol-free diet for 16 weeks do not show the visible symptoms and histological changes associated with muscular dystrophy. The tissues of the

animals were, however, completely depleted of tocopherol reserves at the end of this period. Oxygen uptake measurements on tissue homogenates do not reveal any difference in the rates of oxidation of succinate by liver and heart in the control and deficient groups although the kidney and brain of the deficient group consume less oxygen on succinate. In contrast, the testes of the deficient group consume twice as much oxygen as those of the control group. Tetrazolium reduction by kidney homogenate is 300 per cent more in the deficient group than in the control group.

Proteins of double bean (*Faba Vulgaris* Moench): Part I—Isolation, fractionation and amino acid composition of the proteins, by Kunjlata Kothary and Kamala Sohoni, *J. sci. industr. Res.*, 1960, 19 C (1), 14.—Three major proteins have been isolated from the aqueous extract of double bean by ammonium sulphate fractionation (0.750 and full saturation of ammonium sulphate) and the nitrogen distribution in the proteins has been studied. The essential amino acid composition of the proteins, determined microbiologically, shows that, compared to casein, the double bean proteins are deficient in methionine, lower in leucine, isoleucine and valine, but are comparable in histidine, tryptophan and phenyl alanine contents.

Proteins of double bean (*Faba Vulgaris* Moench): Part II—Studies on *in vitro* digestion, by Kunjlata Kothary and Kamala Sohoni, *J. sci. industr. Res.*, 1960, 19 C (1), 16.—The availability of essential amino acids from the double bean proteins C, C₁ and D₁ isolated earlier, has been investigated by subjecting them to digestion, *in vitro*, by (i) pepsin, (ii) trypsin and (iii) pepsin followed by trypsin, and compared with that from casein subjected to similar treatment. Protein C has been found to be 50 per cent less digestible than casein when subjected to peptic digestion. The digestibility of all the double bean proteins is

very poor compared to that of casein when they are digested by trypsin. The double bean proteins are slightly less digestible than casein when digested with pepsin followed by tryptic digestion. Evidence is presented to show that a trypsin inhibitor is associated with the double bean proteins.

Amino acid and vitamin contents of yeast hydrolysate from distillery sludge, by Rastogi, M. K. Saxena, K. C. and Agarwala, S. C., *J. sci. industr. Res.*, 1960, 19 C (1), 18. —Yeast hydrolysate prepared from distillery sludge has been analysed and found to contain sufficient amounts of riboflavin, thiamine and niacin, in addition to all the essential amino acids. The product compares well with dry brewer's yeast and is useful as a supplement in growth media for microorganisms and in protein deficiency diseases.

Studies on pulse proteins: Association with thiamine and nicotinic acid content of pulses, by Esh, G. C., and De, T. S., *J. & Proc. Inst. Chem.*, 1960, 32 (1), 14. —Thiamine and nicotinic acid contents in both low and high protein samples of seven kinds of pulses such as Bengal gram, green gram, red gram, black gram, dried peas, khesari and lentil have been estimated. Thiamine and nicotinic acid in 13 samples of Bengal gram grown from different strains have also been studied. The results tend to show significant variation in the occurrence of these three essential nutrients as a result of strain difference. The strains yielding samples with high protein content may not give high value of either thiamine or nicotinic acid and vice versa.

Effect of dietary deficiencies of folic acid and choline on lipid metabolism in the rat, by Dalal, F. R., *et al.*, *Indian J. med. Res.*, 1960, 48 (1), 59. —In folic acid-deficient rats reared on a 5 per cent casein diet, low in choline and methionine, there is improvement in tissue phosphorylcholine levels after supplementation with either choline or folic acid; together their effects

are more. Other observations reported relate to liver levels of total choline, methionine, nitrogen, lipids and SH and to *in vivo* conjugation of glycine and administered *p*-aminobenzoic acid as well as uptake of inorganic phosphate by liver mitochondria. A study of fat absorption in relation to dietary levels of choline and folic acid and choline in lipid metabolism are discussed.

Folic acid and labile methyl oxidation, by Fatterpaker, P., *et al.*, *Indian J. med. Res.*, 1960, 48 (1), 67. —The influence of dietary supplements of folic acid, choline and methionine on the oxidation of methionine-methyl to CO₂ and formate by liver enzymes of rats reared on a low-choline-low-methionine-folic acid deficient diet, has been studied. These supplements were found to increase the methionine oxidation *in vitro*. Urinary excretion of formate is reduced in group, receiving folic acid or methionine. Studies on *in vitro* oxidation of methionine-¹⁴CH₃ also showed a reduction in the formation of C₁₄-formate in group, receiving folic acid although the ¹⁴CO₂ formed was unaffected by folic acid. Evidence is provided suggesting that formate oxidation in normal rat liver is not necessarily catalase linked. The implications of these observations in elucidating the function of folic acid are discussed.

Influence of dietary glycine and serine on lipid metabolism in the rat in folic acid deficiency by Prema Fatterpaker and Sreenivasan, A., *Indian J. med. Res.*, 1960, 48 (1), 73. —On an 8 per cent casein diet, low in choline and methionine, the utilization of added glycine or serine by the growing rat requires the presence of adequate amounts of folic acid. In folic acid-fed groups the extra dietary glycine and serine are utilized efficiently for the synthesis of choline and methionine hence reducing the lipogenic manifestation of glycine toxicity. A supplement of l-cystine improves liver levels of methionine and

choline, suggesting the possibility that utilization of methionine precedes choline synthesis *de novo*.

Studies on pyridine nucleotide metabolism. Part IV. Effect of protein deficiency on Ribosyl nicotinamide synthesis by rat liver preparations, by Tulpule P. G., *Indian J. med. Res.*, 1960, 48 (1), 96. —Nicotinamide riboside (NR) synthesis from nicotinamide and ribose-1-phosphate by partially purified liver preparations was studied in normal and protein deficient rats. The evidence presented indicated that in the chain of reactions in the formation of DPN from nicotinamide, NR synthesizing enzyme system of the liver of rat is not as sensitive to protein depletion as the later step in the synthesis of DPN from NMN and ATP reported earlier. Studies with blood have shown that in rat the effect of protein depletion on DPN concentration of this tissue is a reflection of its concentration in and synthesizing capacity of the liver.

DAIRY

Composition of milk, by Prafulla, H. B. and Anantakrishnan, C. P., *Indian J. Dairy Sci.*, 1960, 13 (1), 24. —There was a strong, positive correlation between the Na and chlorine contents of both cow and buffalo milk. The correlation between K and chlorine was also positive for both cow and buffalo milk though not very highly significant. The correlation between chlorine and lactose contents was negative for both cow and buffalo milk, the relation in the latter being not highly significant statistically. The relation between Na and K contents of cow milk was positive and highly significant, whereas no such relation was observed in the Na and K contents of buffalo milk. The correlations, between milk yield and the yields of Na, K, chlorine and lactose, were all positive and highly significant statistically.

FRUIT AND VEGETABLE PRODUCTS

Storage loss of sulphur dioxide in ripe mango pulps preserved

with bisulphites, by Bose, A. N. and Lodh, S. B., *J. & Proc. Inst. Chem.*, 1960, 32 (1), 9.—An investigation carried out for finding the loss of SO_2 from Fazli mango pulp preserved with 1000 p.p.m., 750 p.p.m., and 500 p.p.m., of SO_2 and Langra mango pulp preserved with 1000 p.p.m. and 750 p.p.m., at their natural pH and stored at room temperature showed that the rate of loss of SO_2 was less when the initial concentration was 1000 p.p.m. of SO_2 than with other concentrations of SO_2 for both the varieties of pulp. The relative loss of SO_2 was less in case of Langra pulp than that occurring in case of Fazli. The loss of SO_2 from the pulp having initial SO_2 content of 1000 p.p.m. was 560 p.p.m. in 156 days in case of Langra while that in case of Fazli was 550 p.p.m. in 86 days. The pulp with initial SO_2 content of concentration 750 p.p.m. spoiled in case of Langra in 130 days when its SO_2 concentration was 404 p.p.m. and in case of Fazli it was spoiled in 47 days only when it contained 359 p.p.m. of SO_2 . Fazli pulp preserved with 500 p.p.m. of SO_2 was fermented in 29 days when its SO_2 concentration was 253 p.p.m. Determination of loss of SO_2 from Kanchanlangra pulp stored at 37°C showed that the losses of SO_2 from pulp having initial SO_2 content 1000 p.p.m. and 750 p.p.m. were 375 p.p.m. and 340 p.p.m. respectively after 6 months' storage.

OILS AND FATS

Studies on edible oils. Part I: Nutritive value of heat-treated oils, by Esh, G. C., *et al.*, *Ann. Biochem. exptl. Med.*, 1960, 20 (8), 41.—Authentic samples of crude arachis oil, purified arachis oil, 'Dalda' (hydrogenated arachis oil), mustard oil, sesame oil and 'Cocogem' (purified coconut oil) were heated to 180°C for different period of time upto 10 hours in open air and their nutritive values compared

with that of fresh oils. In all cases iodine value of the heated oil declined and acid value remained almost constant. Peroxide value of the oils with initial low value increased whereas that with initial high value declined as a result of heat treatment. When fed to weanling rats at 10 per cent level in the diet for 28 days 1-hour heated oils had no marked adverse effect on the growth rate, whereas 10-hr. heated oils had a significant growth depression in all cases. Coconut oil, however, tended to show least such effect. Liver and kidney data did not demonstrate any change in the body-weight organ ratio. The relative association of lower iodine value, change in peroxide value, degree of heat treatment and level of heated oil in the diet with thermal deterioration of the oils have been discussed.

Safflower seed and oil: Part II. Composition and utilisation, by Bhojraj Naidu, N., *Indian Oil-seeds J.*, 1960, 4 (2), 70.—In India safflower acreage is estimated at 1.3 million mostly in Bombay, Mysore and Andhra Pradesh. The composition of safflower seed, meal and oil are given. The importance of the oil for the edible and industrial purposes lies in the presence of large amounts of linoleic acid (75 per cent), useful against heart diseases and in surface coatings. The methods of milling the seed by bullock-driven ghanis, hydraulic presses and the solvent-extraction methods as practised in Australia are described. Refining losses are very low, and bleached oil colour very light. The oil may be used as a salad oil for hydrogenation and as an ingredient in many food and pharmaceutical products; but its stability is poor and the use of antioxidants need study. Decortication of the seed gives approximately 40 per cent protein meal suitable for laying-hen ration. The drying qualities of safflower seed oil and

its bodied and polymerised oil are reviewed.

GENERAL

Hardboards from coconut fibre, by Joseph George and Joshi, H. C., *Res. & Ind.*, 1960, 5 (3), 66.—Coconut fibre has been tried as a possible raw material for the preparation of hardboards. It has been found that a milk softening treatment to the fibre improves the felting quality of the pulp produced and gives a stronger board than that obtained with pulp from untreated fibre. The AA have reported the results of their studies on the use of fibre from unretted coconut husk and coir shearing waste for the preparation of hardboards. Coconut fibre and coir shearing waste were softened by suitable alkali treatment and pulp was obtained from them at yields of 65 and 70 per cent respectively. The pulp was formed into a felt in a laboratory board-forming machine. For some boards, one per cent rosin soap or 0.5 per cent phenolformaldehyde resin on the dry wt. of the pulp was used as a sizing agent. The felt was removed and pressed in a hydraulic steam-heated press at $145\text{--}150^\circ\text{C}$ for 15 minutes at pressures of $17.5\text{--}50\text{ kg./sq. cm.}$ Tempering was given to some boards by employing heat treatment or oil. After conditioning the boards to a moisture content of 8-10 per cent, they were tested for modulus of rupture and water absorption. The characteristics of the boards obtained by different treatments are given. The results indicate that boards from unretted fibre have better strength properties than those from coir shearing waste. The high water absorption property found in both the types can be considerably reduced by using sizing agent or by oil tempering. Cashewnut shell liquid is found to be more effective than linseed oil in reducing water absorption.

K.L.R.

PART III (Foreign)

ADDITIVES

Use of emulsifiers and emulsified oils to reduce cohesion in canned white rice, by Ferrel, R. E., Kester, E. B. and Pence, J. W., *Food Technol.*, 1960, 14 (2), 102.—Short-grain or pearl rices, produced principally in the western states, normally are quite sticky as well as cohesive when cooked. The sticky character was largely overcome by a canning process developed at this USDA laboratory. An undesirable degree of cohesiveness remained, however, making the rice difficult to remove from the container and to separate into individual kernels. This report is concerned with treatment of the rice with surface-active materials and vegetable-oil emulsions to reduce cohesion between kernels without affecting other properties of canned rice. A rinse treatment with dilute vegetable-oil emulsions or dilute dispersions of certain surface-active agents during canning proved to reduce markedly the cohesion. Cold storage of the product after canning was also beneficial. Neither the type nor concentration of emulsifier in the emulsion influenced significantly the degree of cohesion in treated products. Emulsifiers differed in their effect upon cohesion when used alone, but no correlation with their type or structure was evident. Reduction of cohesion in the rice was directly related to the logarithm of oil concentration in the emulsions. Amount of oil taken up by the rice reflected the concentration of oil in the emulsion but barely exceeded 1.0 per cent even at a level of 15 per cent oil in the rinse. When oil level was below 5 per cent in the rinse, a taste panel could not reliably distinguish between treated and untreated rice. No change in organoleptic properties appeared in treated rice after 19 weeks of holding at 100°F. Small though significant differences in cohesiveness were found among treated

samples of milled rice of different age and crop year.

ANTIOXIDANTS

Antioxidants in dry fat systems: Influence of the fatty acid composition of the substrate, by Lea, C. H., *J. Sci. Fd. Agric.*, 1960, 11 (3), 143.—The activities of a number of antioxidants have been compared at 37° and 50° in purified distilled methyl esters of cottonseed, linseed and cod liver oil fatty acids, to which a small quantity of the pre-oxidised ester had been added as 'starter'. Relative activities were found to vary considerably with the fatty acid composition of the substrate and with the temperature and level of oxidation at which the measurements were made.

BIOCHEMISTRY AND NUTRITION

The effect of diet on serum cholesterol levels in the normal rat, by Lushbough, C. H., *et al.*, *J. Amer. Oil Chem. Soc.*, 1960, 37 (2), 98.—In a long-term study of the effects of specific nutrients upon the serum cholesterol levels in individual rats, average serum cholesterol levels increased between 29 and 41 weeks in all experimental groups, and small consistent decreases were observed between 41 and 50 weeks. Serum cholesterol levels increased slightly with increasing levels of casein in the diet when increased levels of fat were fed. The substitution of 1 per cent cholesterol for either lard or corn oil resulted in increased levels of serum cholesterol and increased variability among the animals within each experimental group.

The utilization of some B vitamins administered to the rat apart from the diet, by Sarett, H. P. and Morrison, A. B., *J. Nutr.*, 1960, 70 (1), 37.—Two experiments were conducted to determine whether limiting amounts of thia-

mine, riboflavin, pyridoxine and pantothenic acid are used as well by growing rats when given apart from the diet as when given with the diet. In the first experiment, one group of animals received these vitamins in the diet throughout the day, while a second group received an equivalent amount of the vitamins once a day by stomach tube. The results showed no significant difference in average weight gain or efficiency of food utilization.

In the second experiment, the animals were first trained to consume their daily food within one hour to permit administration of B vitamins apart from the diet (either immediately after eating or several hour later). The weight gain of these animals was similar to that of the pair-mates which received the vitamins in the diet. Significantly more water was consumed by rats receiving the vitamins in the diet, and these animals had relatively smaller kidneys than those receiving the vitamins separately. B vitamins administered separately from the diet once each day appear to be as well utilized as those incorporated in the diet.

Zinc requirement and balance studies with the rat, by Forbes, R. M. and Yohe, M., *J. Nutr.*, 1960, 70 (1), 53.—In a series of growth and balance studies concerned with investigating factors affecting the zinc requirement of the young albino rat, increasing calcium level from 0.8 to 1.6 per cent of the diet was observed to depress weight gain at all levels of zinc fed both in diets containing casein and those containing isolated soybean protein. Apparent absorption of dietary zinc and its urinary excretion were not affected by increased calcium. Zinc requirement was 18 p.p.m. with 7 p.p.m. derived from soy protein and the remainder from ZnCO_3 ; 12 p.p.m. with 7 p.p.m. supplied from casein and 5 from ZnCO_3 ; and 12 p.p.m. with 2 to 4 p.p.m. derived from egg white and

the remainder from ZnCO_3 . Apparent absorption of zinc from casein, ZnCO_3 and isolated soybean protein was 84, 51 and 44 per cent, respectively.

Amino acid balance and imbalance. III. Quantitative studies of imbalances in diets containing fibrin, by Kumta, U.S. and Harper, A. E., *J. Nutr.*, 1960, **70** (2), 141.—Amino acid imbalances have been induced in diets containing low levels of fibrin by the addition of (1) relatively small amounts of methionine and phenylalanine and (2) amino acid mixtures lacking in a single amino acid.

The imbalance induced by the former method can be observed when as little as 0.25 to 0.5 per cent of a mixture of methionine and phenylalanine is added to a diet containing 6 per cent of fibrin. The growth depression can be corrected by supplementing this diet with relatively small amounts of the limiting amino acids, leucine, isoleucine, valine and histidine.

The effect of an imbalance in increasing the need for the limiting amino acid has been examined by using amino acid mixtures lacking in leucine, isoleucine, valine or histidine and measuring the growth responses to graded levels of each of these in turn. Measurements of food intake in these experiments indicated that an imbalance reduces the efficiency of utilization of the limiting amino acid.

The depression in growth caused by the addition of methionine and phenylalanine occurs only when the diet contains 6 per cent of fibrin and involves a delicate balance with the next limiting amino acids leucine, isoleucine, valine and histidine. In contrast, the growth depression caused by an amino acid mixture lacking histidine can be demonstrated over a range of fibrin levels.

FRUIT AND VEGETABLE PRODUCTS

Problems in the preparation and handling of hot vended canned foods, by Peterson, G. T., Fox, J. F. and Martin, L. E., *Food*

Technol., 1960, **14** (2), 89.—The preparation and handling of hot vended canned foods present problems of direct concern to the canning industry and to the acceptance of such canned foods in general. Broadly these include: (1) *bacteriological* aspects of preparation, storage and handling of hot vended canned foods; (2) effect of high temperature storage in vending machines on *product quality*; and finally (3) *consumer acceptance* of hot vended canned foods. Aspects of these various problems are discussed. Maintenance of product quality during high temperature storage in the vending machines is of major concern to both the processor and vendor. The processor must determine acceptable quality storage life for his products and reformulate if necessary in order to maintain quality levels comparable to other methods of handling and serving foods. The food service industry also recognizes some problems in this type of merchandising particularly, the sanitation of vending equipment and can openers. Sanitary maintenance of equipment and frequent changing of can openers on a regular schedule have done much to alleviate this problem. Consumer acceptance of both the product and method of consuming (direct from cans) is a joint problem of the food service industry and food processors. It is strongly recommended that food processors do everything possible to develop a wider variety of products as well as to improve existing products to withstand high temperature storage and retain high quality to help overcome 'lower quality' and 'no variety' objections or complaints.

Comminuted orange: A novel process for its manufacture, by Braverman, J. B. S. and Levi, A., *Food Technol.*, 1960, **14** (2), 106.—Since citrus peels contain more than twice the amount of ascorbic acid than does the juice of the endocarpium and all of the essential oil is incorporated in the flavedo, some producers of citrus products have tried to make use of this resource.

One way is to convert the whole of the citrus fruit into an edible product. 'Comminuted orange' is a recently coined term introduced into the trade dealing with citrus products. It means transforming citrus fruit into paste of more or less fine texture by means of some sort of disintegration. Apart from isolated articles and news items in industry journals and a few patents, practically nothing has been published on this subject. Most of the methods of manufacture at present used for comminuting citrus fruit are based on the following main steps: either whole citrus fruits, or the peel alone, or various proportions of juice, rag and peel are mechanically disintegrated and milled to a fine colloidal paste using suitable milling equipment. In some cases the milling is preceded by cooking the peel in double jacketed stainless steel tanks in order to soften it before comminution. What is usually required of a good product seems to be: (a) practical sterility of the product, (b) proper colloidal consistency, (c) retention of vitamin C, (d) inactivation of pectolytic enzymes, (e) good keeping qualities. Existing processes of manufacture seem to have distinct deficiencies and leave much to be desired of the final product. The novel process of manufacture proposed in this article has been fully tried out on both a laboratory and a pilot-plant scale. It consists in heating whole oranges in an Henze apparatus and blowing out the contents, and subsequently finishing and milling the final product. Several important qualities in the final product have been attained by this process: complete sterility of the product, distintegration without mechanical means, and finally inactivation of enzymes. The keeping qualities of the products are described.

Preservative effect of some antimicrobial agents on high-moisture dried fruits, by Nury, F. S., Miller, M. W. and Brekke, J. E., *Food Technol.*, 1960, **14** (2), 113.—In recent years, the dried fruit industry of California has

increased the moisture content of a substantial portion of the total pack of dried prunes and dried figs. It is likely that the trend to a higher-moisture products will embrace other dried fruits, particularly raisins. There is a definite consumer demand for high-moisture dried fruits. These products are very tender, moist, and palatable and can be eaten out of hand. Although these fruits are already a part of the general trend toward ready-to-eat and convenience foods, certain problems of preservation require attention. Several preservatives for high-moisture prunes were tested by incubating treated and inoculated samples. Potassium sorbate and propylene oxide were found to be the most effective. Calcium propionate, dehydroacetic acid, and vitamin K₃ were shown to be considerably inferior under the conditions of these experiments. Potassium sorbate was found to have a residual effect in that the treated prunes did not spoil in open packages.

INSECTICIDES

Detection and estimation of the biologically active constituents of pyrethrum, by Smith, H. J., *J. Sci. Fd. Agric.*, 1960, 11 (3), 172.—A method is described for the determination of Cinerin I, Pyrethrin I, Cinerin II, and Pyrethrin II in pyrethrum preparations based upon quantitative preparation and chromatographic separation of their 2, 4-dinitrophenylhydrazones. The method is rapid and is suitable for routine analysis.

MEAT

The influence of low level gamma irradiation, antibiotic treatment, storage temperature and vacuum packaging on flavour and bacterial changes in cured bacon, by Brown, W. L. and Schmucker, M. L., *Food Technol.*, 1960, 14 (2), 92.—Combination methods of preservation for extending the shelf life of meat products appear to offer numerous advantages over the use of a single method. The objectives of the

present study were to evaluate storage stability and bacterial changes in cured bacon subjected to different handling and storage conditions after slicing. Using bacterial changes and flavour ratings by a trained panel as criteria of product acceptability it was established that holding temperatures, method of packaging, irradiation and addition of an antibiotic each had its effect on the quality of sliced bacon. Results indicated that low storage temperatures (28-32° F) and vacuum packaging were slightly more effective in maintaining an acceptable product than any of the other treatments.

The effect of sugar on the flavour and colour of smoked hams, by Mills, F., Weir, C. E. and Wilson, G. D., *Food Technol.*, 1960, 14 (2), 94.—Sugar has been employed in the curing of meat because, presumably, it has value in (1) enhancement or development of flavour, (2) development and protection of the cured meat colour and (3) retardation of a putrefactive type of spoilage. This article reports a study on the effect of sugar on the colour development and retention and flavour of hams cured three to seven days. Between 0.50-0.75 per cent sugar appears to be required to reach the threshold level for detection of sweetness in hams. This would correspond to 50-75 lb. sugar per 100 gal. of pump pickle. This is probably higher than the concentration of sugar usually employed in commercial practice. Colour analysis indicates no effect of sugar upon colour production or stability. An effect upon the amount of colour development due to length of cure was observed. This would indicate that the effects of sucrose upon colour development and retention noted by other workers on long cure hams are not of significance when curing is limited to a few days. Bacterial flora did not appear to be affected by the treatment. If a sweetening agent is desired in rapidly cured hams, sucrose, dextrose, or a cycylamate appear to be interchangeable.

MICROBIOLOGY

Observations on some beer spoilage lactobacilli, by Harris, J. O. and Watson, W., *J. Inst. Brew.*, 1960, 66 (2), 151.—A suitable medium for the quantitative determination of lactic bacteria is described and the summary of the results of two years experience shows medium and method to be useful for practical microbiological control. Two strains of lactobacilli capable of diacetyl production in beer have been isolated. Their characters are described in some detail and their significance in relationship to beer spoilage is outlined. The effect of pH change on the aerobic and anaerobic growth of a selection of beer lactobacilli is commented upon.

Improved membrane filter technique for rapid identification of spoilage organisms, by Harris, J. O. and Watson, W., *J. Inst. Brew.*, 1960, 66 (2), 162.—A sensitive and rapid method for the identification of organisms isolated on membrane filters is outlined, a centrifugal treatment being employed. The application of this method to the specific problem of beer filtration is discussed, and relevant growth characteristics of beer lactobacilli are described. The technique is applicable to the determination of low degrees of bacterial infection of yeast.

Utilization of sulphur compounds by a brewer's yeast, by Maw, G. A., *J. Inst. Brew.*, 1960, 66 (2), 162.—As part of a study of the sulphur metabolism of a brewer's yeast, an examination has been made of the ability of this organism to utilize various organic and inorganic sulphur compounds as sources of sulphur for growth in place of sulphate. The results obtained show that the conditions under which growth is studied influence considerably the extent to which many of the compounds are utilized. In conditions of inadequate aeration only a relatively small number of the compounds tested supported any growth. When aeration was adequate, a number of

additional compounds became active as sulphur sources. The most effective compounds included sulphite, thiosulphate, glutathione, L-methionine and certain of its derivatives, namely, methionine sulfoxide, S-methylmethionine, homocysteine and the α -hydroxy analogue of methionine. A number of aliphatic sulphonic acids were also well utilized. These were ethanesulphonic acid and the related compounds β -phenylethanesulphonic acid, isethionic acid, ethane-1:2-disulphonic acid and β -sulphopropionic acid. Methanesulphonic acid and related sulphonic acids were, on the other hand, poor sulphur sources. L-Cysteine was not as efficiently utilized as L-methionine, and this was also the case for S-methyl-L-cysteine.

OILS AND FATS

The determination of the neutral oil content of crude vegetable oils, by Basu Roy, Choudhury, R. and Arnold, L. K., *J. Amer. Oil Chem. Soc.*, 1960, 37 (2), 87.—Several recognised methods are in vogue for determining the refining loss of crude vegetable oils but all of them have some limitations. Silicic acid column chromatographic methods is currently used. In this study, the authors have carried out the determination in Erlenmeyer flasks instead of the usual column using reagent grade chloroform and reagent-grade powered silicic acid. The optimum amounts of silicic acid and chloroform required for washing have been standardised. The method proposed for the determination of neutral oil consists in shaking 2-3g. of crude oil, 25 g. of silicic acid and 50 ml. of chloroform in a 125-ml. Erlenmeyer flask for 10 minutes, filtering through a sintered glass funnel under vacuum and washing the silicic acid with five 50 ml. lots of chloroform. The filtrate and washings are combined, evaporated in the chloroform on a water bath and heated to constant weight at 105°C

in a vacuum oven or in an atmosphere of nitrogen. The percentage of neutral oil is calculated from the weights of the extracted oil. The method is quite simple and the results compare with those of the conventional methods.

By washing the silicic acid residues with methyl alcohol followed by evaporation and weighing, the phospholipid contents of the crude oils have been determined. The values are: soyabean oil, 6.25 per cent, corn oil, 5.83 per cent; and cottonseed oil, 3.25 per cent.

K.L.R.

TEA

The phenolic substances of manufactured tea. VIII. Enzymic oxidations of polyphenolic mixtures, by Roberts, E. A. H. and Myers, M., *J. Sci. Fd. Agric.*, 1960, 11 (3), 158.—When a mixture of substrates is acted upon by the tea

oxidase the substrate of lower rH is oxidised preferentially. In tea fermentation, therefore, oxidations are largely limited to those affecting the gallo catechins. When a mixture of two substrates is oxidised mixed dimers are not produced unless both have similar rH values. In tea fermentation there is only a limited coupled oxidation of gallic acid and theogallin. The trace substances Q (now confirmed to be a mixture) are produced by coupled oxidation of gallic acid; oxidation of theogallin probably results in the formation of substances chromatographically similar to the thearubigins. The catechins function as carriers for coupled oxidations of theaflavins, bisflavanols and thearubigins. Such coupled oxidations probably form part of the fermentation process and it is possible that such oxidations of theaflavins and bisflavanols yield thearubigins.

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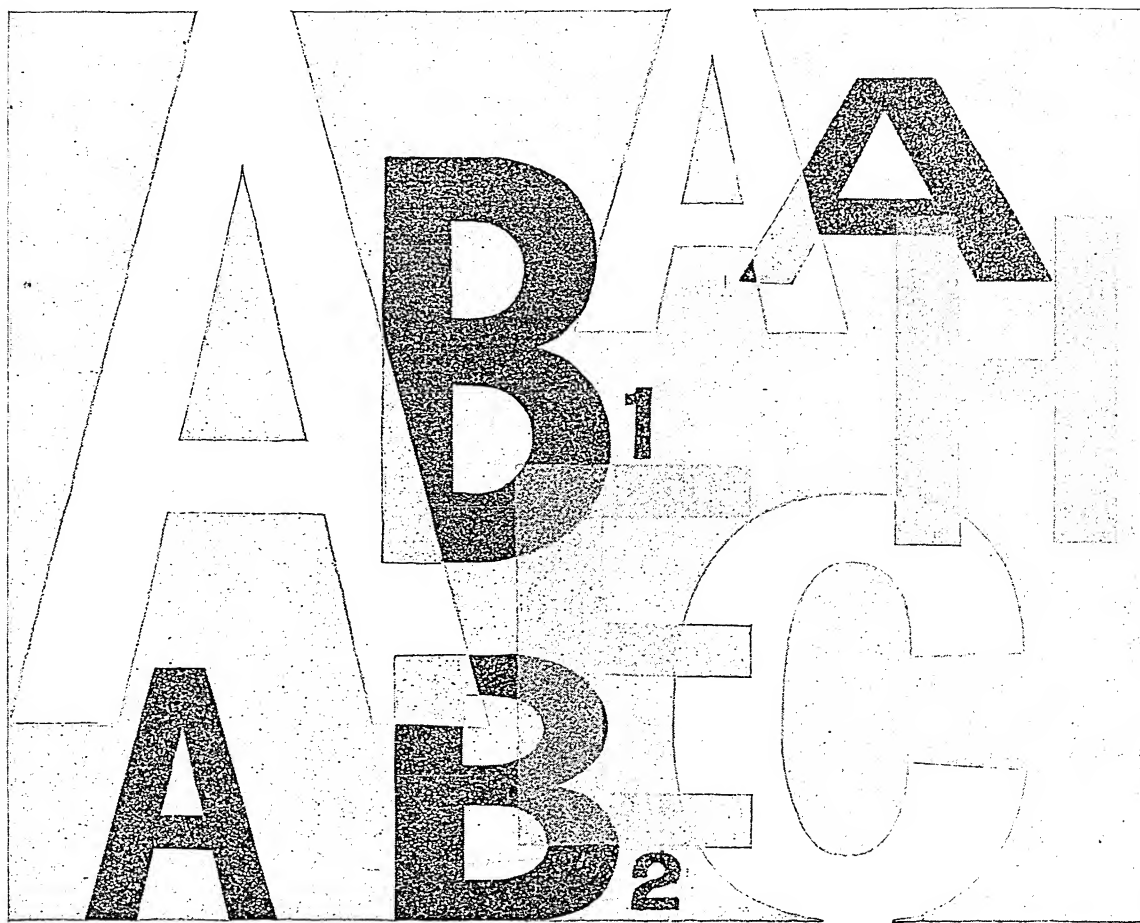
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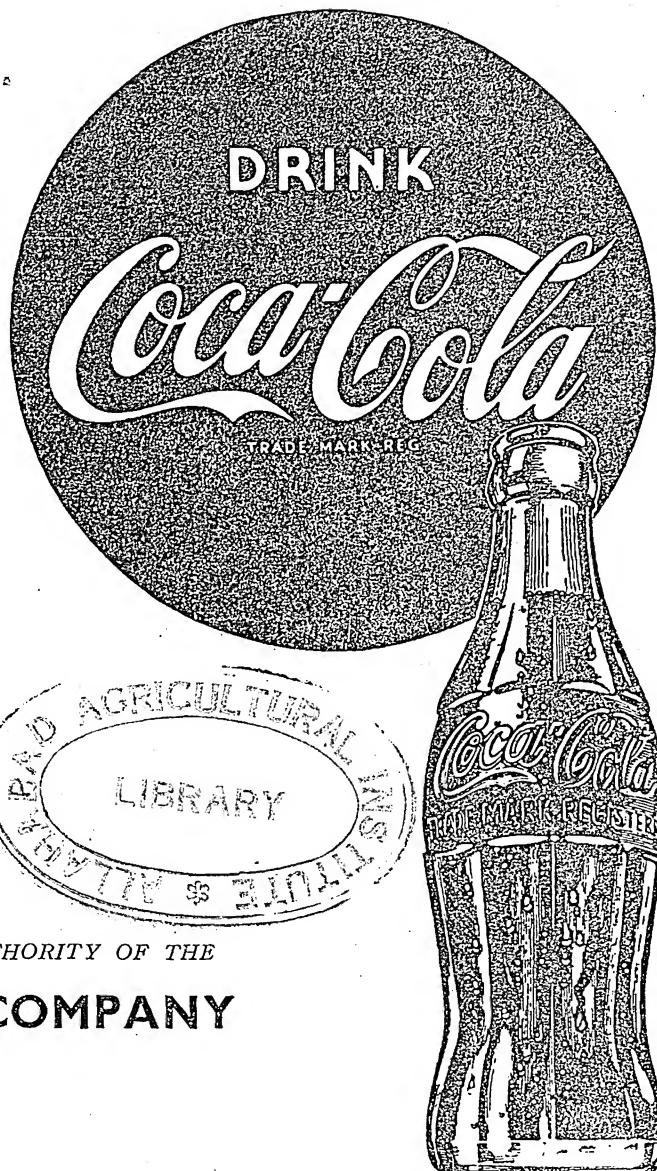
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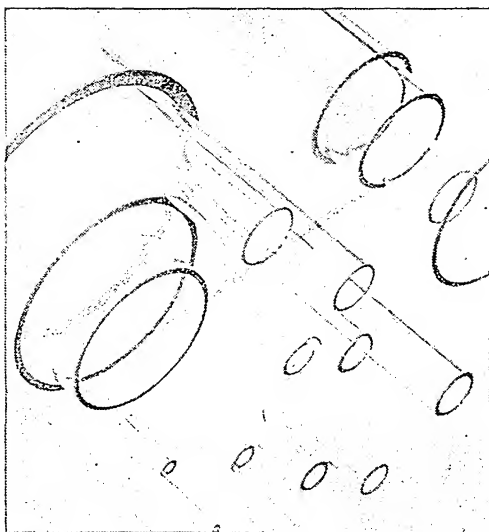
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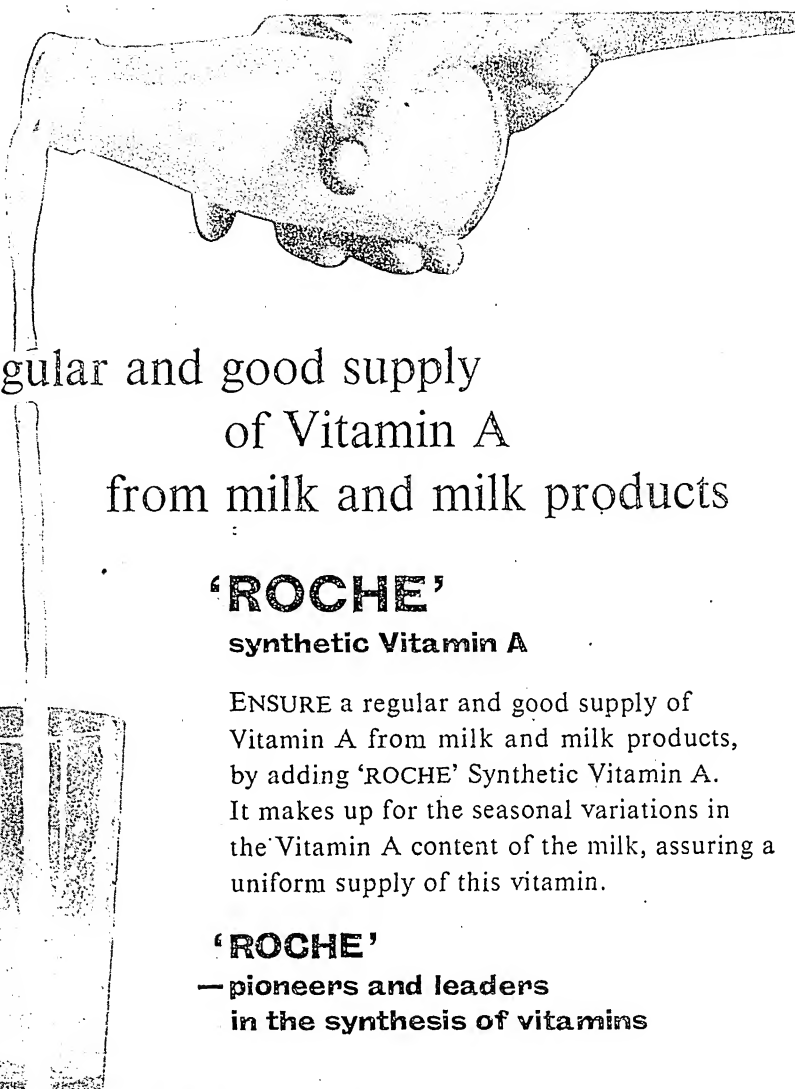
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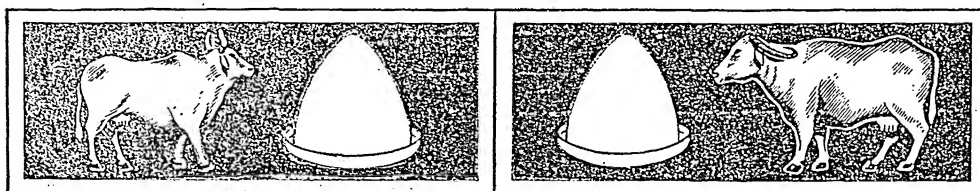
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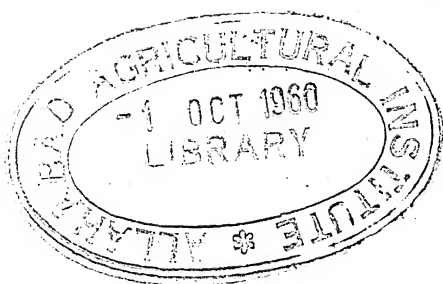
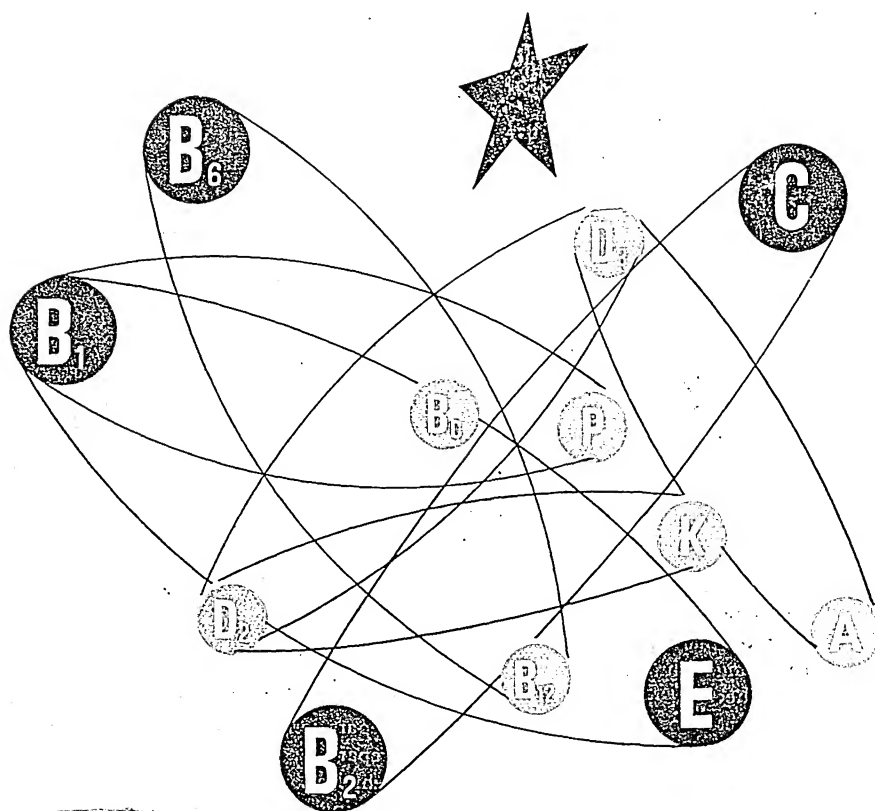
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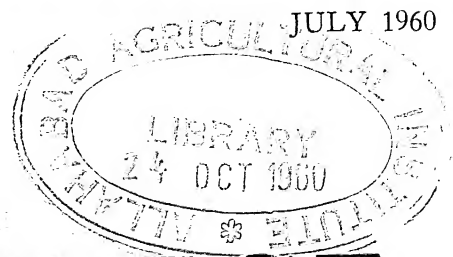


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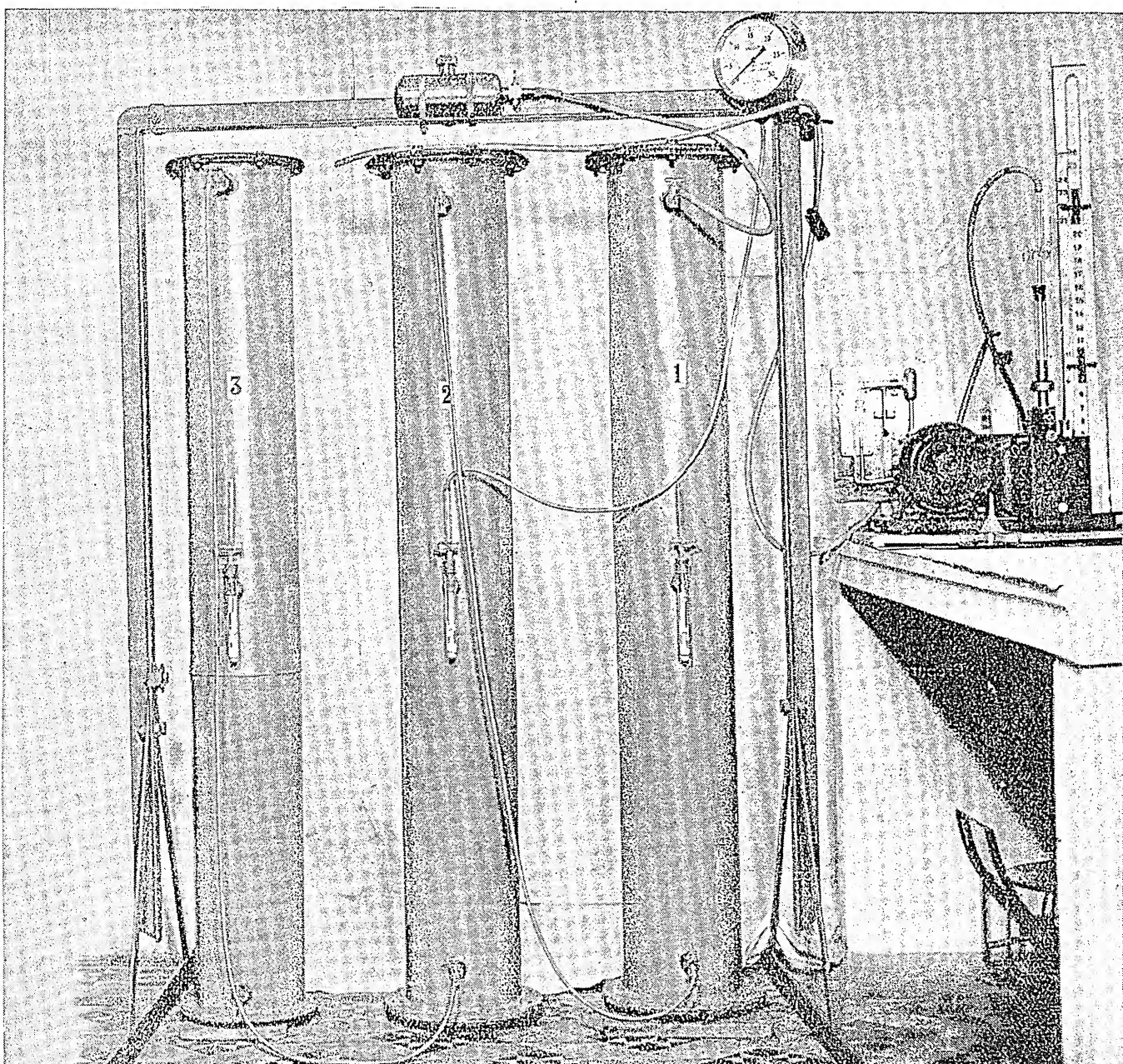
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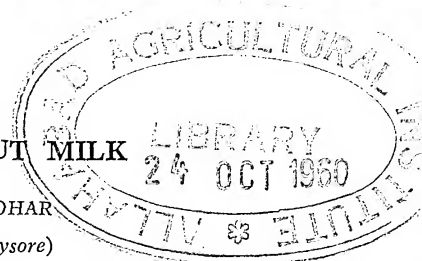
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VEGETABLE CHEESE FROM GROUNDNUT MILK

By M. A. KRISHNASWAMY AND D. S. JOHAR

(Central Food Technological Research Institute, Mysore)



Cheese is a highly concentrated, nutritious and easily digested food. It is an excellent source of protein of high biological value, fat, calcium and several vitamins. The significance of cheese as a food lies not only in its nutritive value but also in its long keeping quality.

There is practically no commercial production of this valuable protective food in the country and what little cheese is being consumed is all imported. During 1955, India imported 11,280 maunds¹ of cheese valued at Rs 16.95 lakhs.

Researches conducted in India during the past two decades have shown that the nutritive value of suitably fortified vegetable milks is nearly as high as that of cow's milk^{2, 3, 4}. Groundnut is not only available in abundance in the country but also quite cheaply. According to available data⁵ India is the leading producer of groundnuts in the world and the country has the potentiality of still larger production. Groundnut can, therefore, serve as an excellent base for vegetable milk

not only for use in different forms, especially as curd and butter milk, but also in the manufacture of products like cheese.

Coagulants of milk: Milk clotting enzymes have been found to occur in practically all varieties of tissues and have been suitably reviewed^{6, 7, 8, 9} from time to time. Despite the large number of proteolytic enzymes available, rennin obtained from the abomasum of the suckling calf has been used extensively in cheese making. Work on the milk clotting enzymes from *Withania coagulans* and its application in cheese making have been reported¹⁰. Krishnamurthi and Subrahmanyam⁸ have reported that the latex from *Ficus carica* (ficin) is more versatile in its clotting action than is rennin, as it clots not only animal milk but also vegetable milks. Thus, from the practical point of view, the milk clotting enzyme from *F. carica* can be used for the manufacture of cheese from vegetable milks on which rennin has no action.

Purpose of the investigation: Though studies of a preliminary nature have been reported⁸ no systematic published data is available either on the technology or quality of cheese by the milk clotting latex from *F. carica*. A preliminary study on the possibilities of manufacturing a vegetable cheese from groundnut milk has been reported¹¹. The present paper reports upon the possibilities of manufacturing a hard type of cheese of acceptable quality from groundnut milk.

Experimental

Preparation of milk clotting enzyme powder: Whitaker¹² working on the ficin content of several varieties of *F. carica* found the ficin from *F. carica* (Linn.) to be most potent in milk clotting. The present studies have therefore been confined to the use of *F. carica* (Linn.).

The latex required for the studies was collected from the Mysore Government Fig Orchard at Srirangapatam. The semi-ripe figs were plucked

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in the early hours of the morning and the latex that oozed out was collected in clean glass test tubes. The latex was preserved in freezing mixture from the time of its collection till it was subsequently processed in the laboratory. The latex was centrifuged and the serum filtered through a Buchner funnel to obtain a clear filtrate of golden yellow colour. Of the several methods tried¹³ for the preparation of enzyme powder, freeze-drying gave the maximum yield. Whitaker¹² observed that freezing did not decrease the enzymatic activity and very little activity was lost on storage at low temperature. For the present studies the dried enzyme was ground to a fine powder and stored at 35-40° F.

The milk clotting activity was checked by the method of Balls and Hoover¹⁴ (modified by Krishnamurthi and Subrahmanyam⁸) as shown in Table I.

TABLE I. *Comparative response of different milks to clotting*

(2 ml. of the milks at 37°C were used and 0.2 ml. of a 0.1% solution of the rennet was used)

	Animal rennet ¹		Vegetable rennet	
	Time of clotting in seconds	Activity Units ²	Time of clotting in seconds	Activity Units
1. 20% Klim whole milk at pH 4.6 ...	45	6750	35	8500
2. Fresh cow milk at pH 4.6 ...	70	4275	62	4800
3. Fresh buffalo milk at pH 4.6 ...	63	4760	42	7142
4. Soya milk at pH 5.8 ³ ...	No clot upto 1 hour	do	95	3150
5. Cashew milk at pH 6.0 ³ ...	do	do	61	4915
6. Groundnut milk at pH 5.8 ³ ...	do	do	12	35000

¹ Hansen's solid rennet (tablets).

² The unite of enzyme is defined as the amount of enzyme required to clot 2 ml. of milk in 2 minutes.

³ Buffering to adjust the pH to 4.6 brought about coagulation prior to the addition of rennet.

A combination of animal and vegetable rennets in different proportions did not clot the vegetable milks. Similarly, mixtures of animal and vegetable milks were not clotted by animal rennet.

Preparation of the enzyme for cheese making: The enzyme powder was ground in a mortar with acid-free sand to get it properly dispersed and the enzyme extract prepared in acetate buffer at pH 4.5 whereby 50 per cent of its proteolytic activity was destroyed, the milk coagulating property remaining unimpaired¹⁵. Maximum activity of the enzyme was attained at the rate of 2 ml. of a 0.1 per cent solution for 100 ml. of the substrate.

Difficulties encountered in cheese trials: One of the essential requirements for the manufacture of a hard type of cheese is the formation of a firm coagulum with rennet that should ultimately become plastic and ductile. This property of the cheese curd is essential for the formation of correct type of body and texture in the cheese. The inherent nature of the groundnut protein did not give a firm coagulum with rennet. Therefore, the conventional method of cheddar cheese could not be employed for the manufacture of cheese from groundnut milk. Several experiments were carried out to improve the gelling capacity of the cheese-curd from groundnut milk, although the weak and fragile nature of the curd could not be improved appreciably.

Manufacture: Cheese samples from milk to serve as control were prepared by the conventional method¹⁶ using milk clotting enzyme from *F. carica* (Linn.). Cheese from groundnut milk was prepared as follows:

Clean roasted and decuticled groundnut kernels were pasted in a micro-pulveriser to peanut-butter consistency and allowed to stand for a few minutes to remove a large proportion of the oil. The paste was dispersed in about 7 parts of water and the pH adjusted to about 7. The dispersion was clarified in the hollow bowl of 'Westfalia' multipurpose centrifuge yielding the starch-fibre fraction. The fat was separated from the clarified dispersion by using the separator bowl of the same centrifuge. The groundnut emulsion thus obtained was deodourised by steaming it for about 30-40 minutes. It was fortified by adding 2.2 g. of calcium phosphate (tribasic) and 1.1 g. of sodium citrate per litre of the emulsion. Commercial lactose was added at 2 per cent level, the mixing of the salts and milk-sugar with the emulsion being effected by homogenisation.

TABLE II. *Initial composition of cheese samples*

Reported standards 16					Experimental								
Types of cheeses	Maximum per cent moisture	Minimum per cent fat		Sample No.	Water %	Total solids % (dry matter)	Fat %	Solids not fat % (Snf)	Total casein or protein (N × 6.25)	Salt %	Casein (Protein) in dry matter %	Fat in dry matter %	
		In dry matter	In total mass										
I. COW MILK (RAW)													
Hard ...	39	50	...	1	38.96	61.04	30.8	30.24	22.01	1.90	36.06	50.47	
Semi-hard ...	50	50	...	2	40.38	59.62	31.0	28.62	24.93	1.27	41.82	53.00	
Soft (cottage)...	80	...	...	3	40.37	59.63	32.0	27.63	21.38	1.76	35.86	53.67
Soft (cream cottage) ...	80	...	4.0	4	40.51	59.49	33.0	26.49	23.12	1.85	38.85	55.44	
Standards for Cheddar cheese													
Per cent				1	53.42	46.58	21.30	25.28	18.95	1.92	40.68	45.73	
Water ...	...	34.82		2	51.80	48.20	19.60	28.60	14.23	1.78	29.52	40.67
Total solids (dry matter) ...	63.16			3	43.50	51.50	20.40	31.10	18.79	1.66	36.20	39.61	
Fat ...	33.75			4	46.36	53.64	22.00	31.64	19.68	1.57	36.68	24.02	
Solids not fat (Snf) ...	29.33			III. GROUNDNUT MILK									
Casein ...	23.72			1	52.29	47.71	18.80	28.91	15.38	1.78	32.23	39.41	
Salts, ash etc. ...	7.61			2	46.11	53.89	20.30	33.59	20.42	2.36	37.87	37.89	
Casein in dry matter ...	37.55			3	54.93	45.07	19.50	25.57	16.47	1.51	36.54	43.26	
Fat in dry matter ...	51.77			4	49.60	50.40	21.50	28.90	17.55	1.49	34.82	42.95	

The pH of the emulsion was reduced to about 5.8 (with phosphate buffer), optimum for the action of the vegetable rennet. The milk was rennetted at the rate of 2 ml. of a 0.1 per cent buffered solution (pH 4.5) per 100 ml of the substrate. The coagulum was cut vertically and horizontally and left undisturbed for about 15 minutes. The cut curd was gradually raised to about 60° C and held for 30 min. to expel as much of the moisture as possible. The precipitated and cooked mass was filtered through muslin and then clarified twice for further removal of moisture.

The cheese material accumulating in the clarifier bowl was collected, salted, creamed (groundnut cream) and coloured. Latic-culture was then added and the product thoroughly mixed, hooped and pressed in a small basket type press.

After expulsion of the required amount of moisture from the cheese curd, it was taken out and kept at low temperature for a day or two to form a rind. The cheese was then paraffined by dipping it in molten paraffin at 240°-250° F for 3 to 5 seconds. The steps involved in the manufacture of cheese from mixed milk were the same as for groundnut milk cheese except that the two types of milks were mixed in equal amounts. The finished cheese samples were ripened at a temperature of 50° F with a relative humidity of 85 to 90 per cent.

The samples were analysed for their proximate composition (initial) by standard methods and also judged organoleptically. These results are presented in Tables II and III. The prescribed standards for cheese in general and Cheddar cheese in particular have also been recorded in

TABLE III. *Initial organoleptic qualities of cheese samples*

Perfect score	Judge I				Judge II				Judge III				Judge IV			
	Cheddar (Rennet) bazaar sample	Cheddar (F. carica)	Mixed milk (F. carica)	Full groundnut milk (F. carica)	Cheddar (Rennet) bazaar sample	Cheddar (F. carica)	Mixed milk (F. carica)	Full groundnut milk (F. carica)	Cheddar (Rennet) bazaar sample	Cheddar (F. carica)	Mixed milk (F. carica)	Full groundnut milk (F. carica)	Cheddar (Rennet) bazaar sample	Cheddar (F. carica)	Mixed milk (F. carica)	Full groundnut milk (F. carica)
Flavour: 45 ...	30	20	15	10	25	25	15	10	45	25	15	15	30	30	10	15
Body and texture: 30 ...	20	10	10	10	20	20	15	10	30	20	10	10	30	20	15	10
Finish: 15 ...	10	12	10	12	10	10	10	10	15	10	10	10	10	10	10	10
Colour: 10 ...	5	5	5	5	8	35	5	5	10	5	5	5	10	10	5	5
Total: 100 ...	65	47	40	37	63	90	45	35	100	60	40	40	80	70	40	40

TABLE IV. *Variation in composition of cheese samples during ripening*

Days of ripening	Water %	Total solids % (dry matter)	Fat %	Solids not fat (%) (Snf)	Total casein or protein (N×6.25)	Casein (protein) in dry matter %	Fat in dry matter %	pH
I. MILK CHEESE								
0 days ...	39.46	60.54	27.0	33.54	25.62	42.31	44.61	...
30 days ...	38.35	61.75	28.0	33.75	25.20	40.81	45.34	5.5
45 days ...	38.53	61.47	28.0	33.47	25.19	40.64	45.55	5.76
70 days ...	37.11	62.89	27.9	34.89	26.73	42.50	44.52	5.92
II. MIXED MILK CHEESE								
A. (Groundnut and broken cashew kernels)								
0 days ...	43.25	56.75	18.50	38.25	19.20	33.83	32.60	4.10
30 days ...	42.58	57.42	18.25	38.17	22.84	31.78	31.96	4.58
45 days ...	42.23	57.77	18.00	39.77	22.12	38.29	31.16	5.1
B. (Groundnut and cow milk—1:1)								
0 days ...	38.70	61.30	26.0	35.30	28.12	45.82	42.41	4.86
10 days ...	39.15	60.85	26.5	34.35	26.36	43.32	43.31	5.10
25 days ...	39.52	60.49	26.5	34.14	24.05	39.77	43.57	5.50
III. FULL GROUNDNUT MILK CHEESE								
A								
0 days ...	45.10	54.90	20.0	34.90	20.29	30.73	36.43	...
15 days ...	44.26	55.74	...	...	21.41	38.41	...	5.26
25 days ...	43.69	56.31	21.0	35.31	20.46	36.34	37.29	5.18
40 days ...	44.30	55.70	20.8	34.90	20.92	37.35	37.35	5.12
B								
0 days ...	39.01	60.99	20.50	40.49	35.91	58.88	33.62	4.58
15 days ...	38.92	61.08	20.30	40.78	34.89	57.10	33.24	5.00
40 days ...	38.69	61.31	20.25	41.06	34.34	56.01	33.16	5.10
60 days ...	38.90	61.10	20.10	41.00	33.77	55.27	32.91	5.48

Table II. More samples of cheese were prepared with improved body and texture and reduced moisture content so as to come closer to a hard type of cheese. These samples were ripened at 50° F with a relative humidity of 85-90 per cent. The changes in chemical composition as well as organoleptic qualities of some of the ripened samples are presented in Table IV and V.

TABLE V. *Organoleptic qualities of cheese samples during ripening*

		Perfect score	Sample score	
			30 days	45 days
<i>Milk</i>				
Flavour		45	40	40
Body and texture		30	20	20
Finish		15	10	10
Colour		10	10	10
Total		100	80	80
<i>Mixed milk (A)</i>				
Flavour		(slightly rancid)	20	20
Body and texture			10	10
Finish	do		5	5
Colour			5	5
Total		100	40	40
<i>Mixed milk (B)</i>				
Flavour	do		10 days 25	25 days 30
Body and texture			15	10
Finish			8	7
Colour			4	5
Total		100	52	52
<i>Groundnut milk (A)</i>				
Flavour	do		15 days 28	40 days 30
Body and texture			15	10
Finish			10	12
Colour			4	4
Total		100	57	56

Discussion

A comparison of the results in Table II shows that while the cheese made from animal milk fitted in more or less with standards for hard cheese, cheese from mixed and groundnut milks fell into the category of semi-hard cheese. The very weak and fragile nature of mixed and ground-

nut milk curds were responsible for the incomplete removal of moisture. Unlike the cheese curds from animal milk, the cheese curds from mixed and groundnut milks were difficult to handle, which also resulted in considerable amount of loss in the cheese solids during manufacture. Application of excessive pressures to reduce the moisture content of mixed and vegetable milk cheeses, resulted in the displacement of oil from the cheeses. The mixed and groundnut milk cheeses had slightly nutty flavour that impaired their qualities as cheddar type of cheese.

Ripening of cheese is a highly complex process and in spite of the enormous work that is being done on this subject, the process is still to be correctly understood. Though in general, there is a gradual loss of moisture in cheese by evaporation during ripening, in the case of all samples reported in Table IV, the loss of moisture was not very appreciable. Paraffining of cheese reduces the loss of moisture in it and the inappreciable losses of moisture in the ripened samples may be due to the above factor. The fat in the cheese samples does not seem to have undergone any appreciable change, though lipolytic changes are important for flavour production. Changes in the protein values of cheese samples have also not been of much significance. This may be explained by the fact that the extent of protein break down decreased with increasing severity of heat treatment¹⁷. There has been a slow but steady increase in pH of most of the samples.

Organoleptic scorings are no doubt of significance in the merchandising of cheese and from this angle, mixed and groundnut milk cheeses need considerable improvements.

Summary

The possibilities of manufacturing an enriched and highly concentrated protein food in the form of a vegetable cheese from groundnut (peanut) using the highly potent and versatile milk-clotting enzyme from *Ficus carica* (Linn.) have been shown. The major chemical composition and organoleptic properties of such a product have been compared with that of a hard type of cheese (cheddar) from milk.

Acknowledgement

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KEEPING QUALITY OF TAPIOCA AND NUTRO-MACARONI

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Subrahmanyam *et al.*¹ have standardised the method of manufacture of tapioca and nutro-macaroni. These processed grains are easy to cook and are palatable. They possess a higher nutritive value than rice². Narayanan *et al.*³ have reported the effect of method of processing and cooking on the nutritive value of nutro-macaroni. Subrahmanyam *et al.*⁴ have found that the incorporation of nutro-macaroni in the daily diet of children improved their general health and nutritional status to a considerable extent. It has been reported that wheat macaroni products packed in paper or cloth bags can be kept for a few years without any deterioration of quality⁵.

The present investigation deals with the keeping quality of tapioca and nutro-macaroni packed in different containers.

Experimental

Tapioca macaroni, both steamed and roasted, were processed in the pilot plant according to the method of Subrahmanyam *et al.*¹. One lb. lots of

these products were packed in small bags made of polythene (200 gauge), brown paper (.0025" thickness), cloth (white drill) and gunny (B. twill). Twelve bags from each group were kept at room temperature and another twelve at 37° C and 70 per cent relative humidity. Similarly, nutro-macaroni prepared according to the method of Narayanan *et al.*³ were packed in 1 lb. packets of polythene (250 gauge) and paper bags (.0025") and kept at room temperature and at 37° C and 70 per cent R.H. Care was taken to prevent infestation.

Samples were drawn every month and examined both chemically and organoleptically. Estimations for moisture, free fatty acids and total solids in the gruel were made. Moisture and free-fatty acids were determined by A.O.A.C.⁶ methods. The gruel loss was estimated as follows: 25 g. of macaroni were put into 250 c.c. of boiling water and the boiling was continued for 5 minutes in the case of tapioca macaroni and 10 minutes for nutro-macaroni. At the end of

this time the cooked macaroni was drained through a strainer for 5 minutes. The gruel after cooling was made up to volume and an aliquot portion was evaporated to dryness in a tared petri dish and percentage loss was calculated. The grains, before and after cooking were carefully examined for any off-flavour, bad taste, etc.

Results and Discussion

Table I records the moisture content of stored macaroni samples. There is no appreciable change in the moisture content of steamed tapioca macaroni (10.3–9.8) and nutro-macaroni (11.8–11.3) whereas roasted tapioca macaroni shows an increase in moisture content for the first four months and then remains at that level for the rest of the storage period.

In the case of samples kept in polythene bags the moisture content increased from 6.7 per cent to 8.9 per cent whereas in all the other three samples the moisture content increased from 6.7 per cent to 10.9–11.5 per cent. There was a slightly less increase in moisture content of samples at 37°C than those at room temperature.

TABLE I. *Moisture content in tapioca macaroni**

Period of Storage (Months)	Room Temperature 17°C–33°C. R. H: 45–85%				Temperature: 37°C R. H: 70%			
	ROASTED %				ROASTED %			
	Alkathene	Paper	Cloth	Gunny	Alkathene	Paper	Cloth	Gunny
0	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
1	7.5	9.4	9.3	10.0	7.3	7.3	8.5	10.3
2	8.5	9.6	9.7	10.4	8.5	9.1	9.9	10.5
3	8.5	9.9	10.1	10.4	8.5	9.7	10.1	10.5
6	8.7	10.5	10.7	11.0	8.5	9.9	9.9	10.5
9	8.7	10.6	10.7	11.2	8.6	10.0	9.9	10.5
12	8.9	10.9	10.9	11.4	8.6	10.1	10.2	10.7

* The moisture content of steamed and nutro-macaroni is not recorded as there was no appreciable change in it. The value varied from 10.3–9.8 % in steamed macaroni and 11.8–11.3 % in nutro-macaroni.

TABLE II. *Free fatty acids in tapioca and nutro-macaroni (Expressed as mg. KOH/100 g.)*

Period of Storage (Months)	Room Temp. : 17°C–33°C & R.H. 45–85 %						Temp : 37°C & R.H.-70 %					
	ROASTED				NUTRO		ROASTED				NUTRO	
	Alka-thene	Paper	Cloth	Gunny	Alka-thene	Paper	Alka-thene	Paper	Cloth	Gunny	Alka-thene	Paper
0	43	43	43	43	25	25	43	43	43	43	25	25
1	51	63	65	58	39	41	53	54	57	57	44	41
2	56	60	66	63	44	48	56	60	66	64	46	46
3	65	73	73	73	43	44	66	71	72	72	44	50
4	72	86	88	85	50	53	75	84	86	86	53	55
5	81	98	93	94	59	60	87	101	98	101	62	60
6	86	96	99	97	60	63	92	103	104	107	64	63
7	92	99	100	101	66	70	99	103	108	120	70	72
8	95	102	103	102	74	76	104	108	113	112	79	85
9	102	103	106	107	82	85	109	110	117	118	87	92
10	107	110	111	111	91	95	110	115	120	123	94	100
11	110	116	116	120	96	103	112	116	120	120	99	104
12	115	118	120	125	96	104	112	116	120	120	100	104

TABLE III. *Gruel loss in tapioca macaroni** (Expressed as total solids in gruel per cent by weight)

Period of Storage (Months)	Room Temperature: 17° C–33° C & R. H. 45–85 %								Temperature: 37° C & R. H. –70 %							
	ROASTED				STEAMED				ROASTED				STEAMED			
	Alkathene	Paper	Cloth	Gunny	Alkathene	Paper	Cloth	Gunny	Alkathene	Paper	Cloth	Gunny	Alkathene	Paper	Cloth	Gunny
0	14.4	14.4	14.4	14.4	13.5	13.5	13.5	13.5	14.4	14.4	14.4	14.4	13.5	13.5	13.5	13.5
1	14.5	14.3	14.1	14.5	13.5	13.6	13.6	13.5	14.4	14.0	14.0	14.3	13.5	13.5	13.5	13.5
2	14.5	14.0	13.9	14.4	13.7	13.5	13.2	13.5	13.9	13.9	13.9	13.8	13.5	13.5	13.5	13.1
3	14.5	13.8	13.9	13.8	13.3	13.6	13.2	13.4	13.9	13.9	13.9	13.8	13.5	13.5	13.5	13.0
4	14.0	13.6	13.9	13.8	13.3	13.5	13.2	13.4	13.5	13.8	13.8	13.9	13.1	12.9	13.2	13.0
5	13.5	13.6	14.0	14.1	13.3	13.5	12.9	13.4	13.2	13.6	13.6	13.6	13.0	12.9	13.1	12.9
6	13.2	13.5	13.2	13.9	13.2	13.5	12.9	13.4	13.2	13.3	13.3	12.9	12.7	12.9	13.0	12.5
7	13.0	13.5	13.2	13.5	12.9	13.2	12.5	13.0	13.0	13.0	13.0	12.9	12.5	12.3	12.9	12.5
8	13.0	13.5	13.0	13.5	12.9	13.2	12.4	12.0	13.0	12.9	12.9	12.9	12.5	11.9	12.9	12.0
9	12.6	13.0	12.6	13.0	12.7	13.0	12.1	12.0	12.5	12.3	12.3	11.9	12.5	11.7	12.9	11.6
10	12.6	12.8	12.7	12.8	12.7	12.9	12.1	12.0	12.0	11.9	11.9	11.6	12.1	11.7	12.7	11.6
11	12.4	12.8	12.7	12.5	12.7	12.9	11.3	11.9	12.0	11.8	11.8	11.5	12.1	11.7	12.5	11.5
12	12.4	12.5	12.6	12.4	12.7	12.8	11.2	11.8	12.0	11.8	11.8	11.5	12.1	11.7	12.5	11.5

* Changes in gruel loss of nutro-macaroni are not recorded as there was no appreciable change during storage. The value varied from 4.7–5.3%.

The free fatty acid contents of the stored samples are given in Table II. In the case of roasted macaroni the F.F.A. content increased from 43 mg. of KOH/100 g. of macaroni to 115–125 mg. KOH/100 g. in samples at room temperature and 112–120 mg. in those at 37°C and 70 per cent R.H. after the storage period of 12 months. In both the cases, the values are slightly less in polythene bags than in the other bags. The free fatty acid content of steamed macaroni remained constant in all the samples kept at both the temperatures, the value being 5 mg. of KOH per 100 g. of macaroni. This may be due to the inactivation of enzymes by the steaming operation. In nutro-macaroni the increase was from 25 mg. of KOH/100 g. to 96–104 at R.T. and to 100–104 at 37°C. Here also the values are slightly less in samples in polythene bags.

The gruel loss is given in Table III. Roasted tapioca macaroni shows an improvement in the

general cooking quality and gruel loss on storage. The gruel loss is reduced from 14.4 per cent to about 12.4 per cent after 12 months of storage. This may be due to the curing of the macaroni during storage. Nutro-macaroni does not show any appreciable change in the gruel loss during storage (4.7–5.3). The gruel loss in samples kept at 37°C is slightly less than the samples stored at room temperature.

In general no deterioration is observed in any of the samples after a storage period of 12 months. None of the samples gave any off-flavour or bad taste.

Summary

Storage trials were carried out over a period of one year on steamed and roasted tapioca macaroni rice, and nutro-macaroni (shells) packed in different containers.

The results show that all the three macaroni

products have good keeping quality and store well for more than 12 months under normal conditions. The product is also fairly insect resistant.

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NON-ENZYMATIC BROWNING IN GARLIC POWDER DURING STORAGE

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A detailed survey of literature¹⁻² revealed little published information on the effect of various processing factors, types of packaging and storage temperatures on the flavour (pungency), colour, allyl sulphide, total sulphur, volatile reducing substances (V.R.S.) and antibacterial activity (A.B.A.) in garlic powder. A systematic study³ on the above aspects was, therefore, undertaken at this laboratory. In our earlier communications, some technological aspects⁴⁻⁷ of manufacture, packaging⁸ and storage⁹⁻¹⁰ of garlic powder have been reported. The present report covers the effect of various factors on non-enzymatic browning in garlic powder during storage at different temperatures.

Experimental

Raw material: Garlic powder, freshly prepared on a pilot-plant scale⁷ by the improved technique¹¹ developed at the Institute, was employed during these studies. The powder had no catalase or peroxidase activity.

Experimental sets: Twenty-four experimental sets of garlic powder packed into the following types of containers were stored at (a) 37°C (b) Room Temperature (24-30°C) and (c) at 0-2°C:

1. White bottles, 6 oz. capacity, with air-tight corks
2. Brown bottles, 6 oz. capacity, with air-tight corks
3. Friction-top hermetically sealed tin cans
4. Polythene bags, colourless, 250 gauge, heat sealed

5. Pale white gelatine capsules (translucent)
6. Pink gelatine capsules (translucent).

Besides, garlic powder compressed into plain tablets (without the incorporation of any additives) was also stored at the above three temperatures.

Storage studies: The samples from each experimental set stored at each of the three temperatures were removed after the storage periods of 6, 12, 20 and 40 weeks respectively and examined for non-enzymatic browning as follows:

Non-enzymatic browning: The extent of browning was studied by measuring per cent light absorption in 2 per cent filtered aqueous extracts of garlic powder in a Lumetron photo-electric colorimeter at 420 m μ (blue filter). The results were expressed as optical density (O.D.) at 420 m μ .

Besides, the non-enzymatic browning was also measured quantitatively in a Lovibond tintometer and expressed in terms of the red, yellow and blue units.

Results and Discussion

The data on the non-enzymatic browning as measured in the Lovibond tintometer and as optical density of 2 per cent aqueous extracts at 420 m μ are presented in Tables I and II respectively.

In general, the browning was maximum at 37°C and minimum at 0-2°C, (Fig. 1). However, in between containers stored at 0-2°C and at room

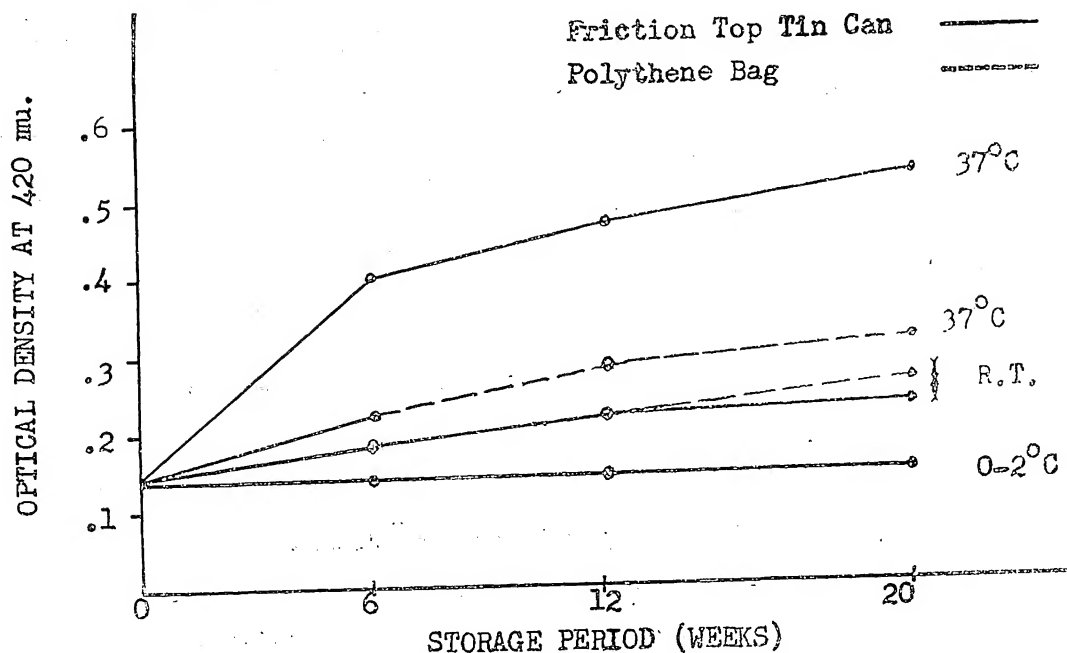


FIG. 1. Non-enzymatic browning in garlic powder (packed in hermetically sealed can and polythene bag) during storage at different temperatures.

TABLE I. Non-enzymatic browning in garlic powder stored at different temperatures as measured by Lovibond tintometer

TABLE I. THERMAL STABILITY				Storage periods in weeks										
Sl. No.	Particulars of packaging			6		12			20			40		
				R	Y	R	Y	B	R	Y	B	R	Y	B
I. At 37°C														
1.	Bottle, white	...	...	2.3	4.0	4.1	7.1	0.5	4.7	7.8	1.3	5.0	7.9	1.4
2.	Bottle, brown	...	...	2.3	4.0	4.0	7.1	0.5	4.5	7.8	1.0	4.9	7.9	1.2
3.	Friction top can	...	...	2.9	4.0	4.9	6.9	0.5	5.3	8.4	1.4	5.5	8.2	1.3
4.	Polythene bag	...	...	2.6	4.0	3.5	5.5	0.4	3.5	5.6	0.6	3.6	5.6	0.7
5.	White capsules	...	...	3.3	5.0	4.9	7.8	0.5	5.3	8.1	1.3	5.7	8.4	1.4
6.	Pink capsules	...	...	3.0	4.1	4.7	7.8	0.5	4.7	7.9	1.3	5.5	8.3	1.4
7.	Tablets, plain	...	...	3.4	5.1	4.0	6.4	0.5	4.7	6.8	1.5	5.5	7.4	1.6
II. At 24-30°C														
1.	Bottle, white	...	...	2.3	3.3	3.9	4.8	0.2	3.9	4.9	0.3	4.0	2.3	0.4
2.	Bottle, brown	...	...	2.1	3.4	2.8	4.8	0.3	2.9	4.9	0.3	3.7	5.2	0.4
3.	Friction top can	...	...	2.1	3.1	2.8	4.8	0.4	2.9	4.8	0.3	3.2	5.0	0.4
4.	Polythene bag	...	...	2.1	3.1	2.8	5.2	0.3	3.4	5.3	0.4	3.0	5.0	0.4
5.	White capsules	...	...	2.6	3.9	3.6	5.8	0.6	4.3	6.7	0.9	4.4	6.9	0.9
6.	Pink capsules	...	...	2.1	3.0	3.2	5.3	0.5	3.4	5.4	0.5	3.9	5.9	0.5
7.	Tablets, plain	...	...	2.2	3.1	2.9	4.8	0.3	3.2	4.9	0.3	3.5	5.4	0.3
III. At 0 - 2°C														
1.	Bottle, white	...	...	2.0	3.1	2.1	3.5	0.1	2.2	3.5	0.1	2.2	3.6	0.1
2.	Bottle, brown	...	...	2.0	3.1	2.1	3.5	0.1	2.2	3.5	0.1	2.2	3.5	0.1
3.	Friction top can	...	...	2.0	3.1	2.2	3.6	0.1	2.2	3.6	0.1	2.2	3.6	0.1
4.	Polythene bag	...	...	2.0	3.1	2.2	3.5	0.1	2.2	3.6	0.1	2.2	3.6	0.1
5.	White capsules	...	...	2.0	3.1	2.3	3.8	0.1	2.4	3.8	0.1	2.5	3.8	0.1
6.	Pink capsules	...	...	2.0	3.1	2.3	3.8	0.1	2.3	3.8	0.1	2.4	3.8	0.1
7.	Tablets, plain	...	...	2.3	3.1	2.4	3.9	0.1	2.4	3.9	0.1	2.4	3.9	0.1

Initial colours value: N = 1.1, R = 2.0, Y = 3.1; Neutral = 1.1 in all the above measurement.
R, Y, B, N, are colour units (Lovibond Tintometer) indicating red, yellow, blue and neutral tints respectively.

TABLE II. *Non-enzymatic browning in garlic powder stored at different temperatures measured as optical density in 2% aqueous solution at 420 m μ*

Type of Packaging	Initial O.D. ^{††}	37°C				R.T. (24–30°C)				0–2°C			
		Period in weeks				Period in weeks				Period in weeks			
		6	12	20	40	6	12	20	40	6	12	20	40
1. Bottle, white ...	.137	.31	.40	.48	.66	.19	.23	.23	.28	.137	.14	.15	.17
2. Bottle, brown ...	.137	.28	.34	.48	.60	.19	.23	.23	.28	.137	.14	.15	.16
3. Friction top can ...	.137	.40	.47	.53	.72	.19	.22	.22	.29	.137	.14	.15	.17
4. Polythene bag ...	.137	.22	.28	.31	.42	.19	.22	.26	...†	.137	.14	.15	.17
5. White capsules*	.137	.31	.51	.55	...	.19	.30	.32	...	.137	.15	.16	...
6. Pink capsules*	.137	.28	.48	.53	...	.19	.26	.30	...	.137	.15	.16	...
7. Tablets, plain*	.137	.31	.495	.57	...	.19	.22	.27	...	.137	.15	.15	...

* Stored in sealed brown bottles.

†† Insect infestation was noticed.

† O.D.=Optical density of 2% aqueous solution of garlic powder at 420 m μ .

temperature, there was no significant difference, but at 37° C, except for polythene bags, where browning was minimum (O.D.=0.31), the corresponding figures for the other containers ranged from 0.48 to 0.57. The lesser browning in powder stored in polythene bags may be due to loss of moisture from the product through polythene. Thus, during 20 weeks' storage period, the moisture came down from 7.3 to 5.0 per cent. This is further substantiated from the tintometer readings (Table I). After about 10 months' storage (40 weeks), the trend of results was the same as after 20 weeks, except that the browning was more.

Role of moisture in non-enzymatic browning:

In order to confirm the above finding that less browning in garlic powder stored at 37°C in polythene bags than that of can at the same temperature, was probably due to the lower moisture level in the former, the following study was undertaken.

Different lots of garlic powder conditioned to different levels of moisture ranging from 5.0 to 28.0 per cent, were packed separately into air-tight, white, glass test-tubes and stored at 37° C for 8 weeks. Colour measurements by Lovibond tintometer were made at regular intervals. The data on the effect of initial moisture level in

garlic powder on colour deterioration are illustrated in Fig. 2, while those on the effect of storage period on colour deterioration in relation to moisture level are presented in Fig. 3.

While studying the effect of initial moisture level alone (prior to storage), it is confirmed that moisture level has a significant effect on colour deterioration, as there was a gradual increase in red and yellow units of tintometer upto a moisture level of about 9-10 per cent, after which, there was almost a steep rise in colour units at about 13 per cent moisture level (Fig. 2), which is also the critical point as reported earlier⁸. However, the rate of colour deterioration slowed down at about 17 per cent moisture level as is clearly illustrated in Fig. 2. This phenomenon was not noticed on such a pronounced level in other powders like onion powder¹², ginger powder¹³, etc. In this respect, garlic powder seemed to behave rather abnormally. However, this seemed to be only a physical phenomenon, as on mild drying, the garlic powder assumed almost the natural colour.

The rate of colour deterioration was greater during storage in garlic powder with higher moisture level and this is indicated by the increase in red units (Fig. 3). There was also a corresponding increase in yellow and blue units. The

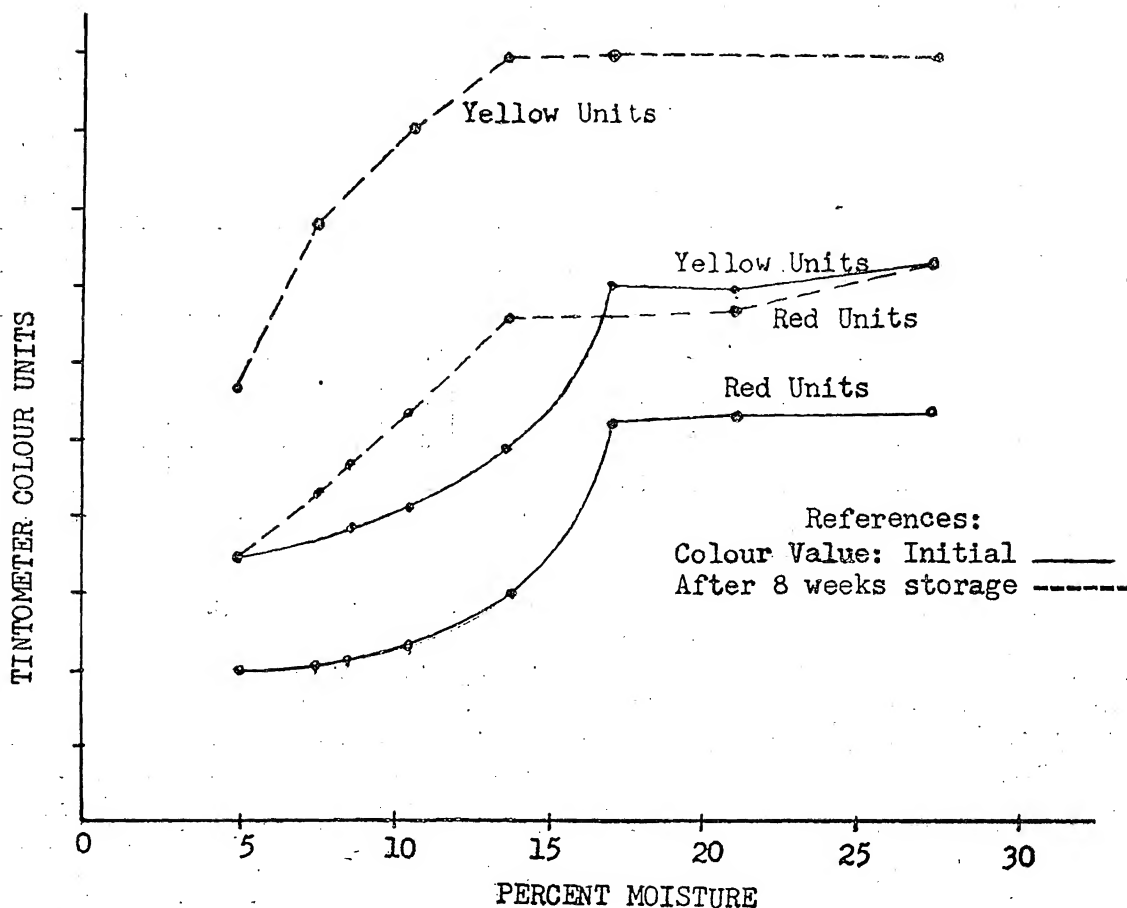


FIG. 2. Effect of moisture level in garlic powder on its colour.

product turned from light yellow at 5 per cent moisture level to dark brown and almost black at 28 per cent moisture level.

This clearly established the fact that the initial moisture level in garlic powder had a pronounced effect on browning of garlic powder during storage, it being further enhanced at higher temperature. This darkening in garlic powder during storage at high temperature (37°C) seemed to be irreversible and did not represent a physical change of state as in the above case. This non-enzymatic browning may be due mostly to Maillard reactions, *i.e.*, the chemical reactions between sugars and amino-acids present in the powder itself.

In conclusion, low moisture in garlic powder, packing of powder in hermetically sealed containers and storage at low temperature ($0-2^{\circ}\text{C}$) are

essential to keep the non-enzymatic browning in garlic powder to the lowest level.

Summary

The paper embodies the results of a detailed study on the effect of various factors like type of packaging, moisture content and storage temperature on non-enzymatic browning in garlic powder and garlic tablets during 10 months' storage.

In general, the browning was maximum at 37°C and minimum at $0-2^{\circ}\text{C}$. In between containers stored at $0-2^{\circ}\text{C}$ and at room temperature ($24-30^{\circ}\text{C}$), there was no significant difference, but at 37°C , except for polythene bag, where browning was minimum (optical density = 0.31), the corresponding figures for other containers ranged from 0.48 to 0.57. The comparatively less browning in polythene bag has been attributed to the

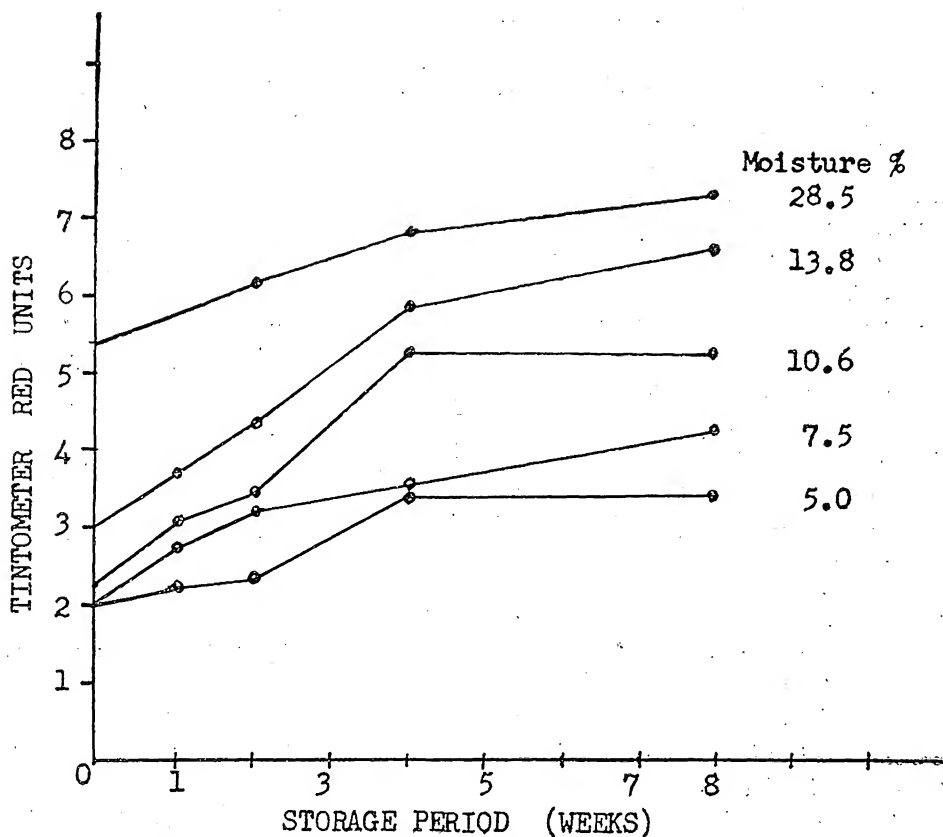


FIG. 3. Effect of moisture content on colour determination in garlic powder during storage at 37°C.

lowering of moisture in garlic powder from 7.3 to 5.0 per cent during storage. The role of moisture in non-enzymatic browning of garlic powder has been discussed and illustrated.

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EFFECT OF POST HARVEST TREATMENT WITH GROWTH REGULATORS ON THE RIPENING OF MANGOES

In the past few years many investigators have shown a great range of effects of growth regulators on the ripening behaviour of certain temperate and tropical fruits. Applications of dilute solutions of growth regulators to fruits before the commencement of storage has been shown to retard ripening¹. The possibility of controlling storage ripening of fruits by applying growth regulators after harvest either before or after storage has also been indicated by Mitchell and Marth². The ripening of any fruit is usually associated with colour changes of the outer skin. Stewart *et al.*³ have observed that the rate of yellowing of lemons was retarded by applying 2, 4-D and 2, 4, 5-T in higher concentrations as a post harvest treatment. In our preliminary trials it was found that the development of surface or skin colour of Coorg mandarins and Alphonso mangoes was reduced considerably by the post harvest treatment at higher doses of 2, 4, 5-T and maleic hydrazide. However, the effect of these growth regulators in high concentrations on the edible properties of fruits needs to be known before such a practice of treating fruits could be recommended for increasing their storage life.

In this study two growth regulators namely 2, 4, 5-trichlorophenoxyacetic acid (ammonium salt) and maleic hydrazide—MH-40 (sodium salt of 1, 2, dihydropyridazine -3-6- dione) were used in two concentrations, *i.e.*, 1000 and 1500 p.p.m. of active ingredients. Tween-20 at 0.5 per cent level was incorporated in the above solutions as a surface active agent. Fully matured and uniform fruits of a similar colour grade were given a dip treatment in these solutions for 2 minutes, then drained and dried immediately in a current of warm air. The treated fruits were stored at room temperature (65-85° F and R.H. 45-85 per cent). At the end of a ten day storage period the fruits were examined for: (i) colour development, (ii) chemical constituents, *viz.*, per cent citric acid and total soluble solids in the edible portion, and (iii) organoleptic quality as judged by a team of six tasters. The data in respect of the above are recorded in Tables I-II.

TABLE I. *Effect of post harvest growth regulator treatment on the nature of ripening of Badam mangoes*
(Period of storage: ten days at 65-85° F & 45-85% R. H.)

Treatment	% green fruit	Organoleptic score
1. Control ...	Nil	Normal desirable ripe taste
2. 2, 4, 5-T, 1000 ppm ...	44	Slightly tart but desirable. Best of all the lots.
3. „ 1500 ppm ...	56	Quite tart taste
4. MH-40 1000 ppm ...	28	Slightly tart
5. „ 1500 ppm ...	32	Slightly more tart, slight off-flavour.

TABLE II. *Effect of post harvest growth regulator treatment on the chemical constituents of Badam mangoes*

Treatment	Initial		Final	
	% Total soluble solids	% Citric acid	% Total soluble solids	% Citric acid
1. Control ...	7.5	2.93	15	0.192
2. 2,4,5-T, 1000 ppm. ...	(composite sample)		16.25	0.192
3. 2,4,5-T 1500 ppm. ...			15.0	0.552
4. MH-40, 1000 ppm. ...			16.25	0.584
5. MH-40, 1500 ppm. ...			15.00	1.130

As observed in a previous study⁴, the fruit receiving growth regulator treatment showed a retardation of the skin colour changes associated with the ripening of fruits. This retardation was more-pronounced in the case of 2, 4, 5-T treated fruits than MH-40 treated fruits. The data also show that the rate of ripening in terms of the loss of acidity and increase in the soluble solids has been affected by the higher concentrations of growth regulators. In the case of MH-40 treatment it was observed that the fruit had an undesirable off-flavour, whereas fruit receiving 2, 4, 5-T treatment at 1000 p.p.m. concentration

was well balanced in its taste characteristics. All judges favoured this treatment over others in respect of taste qualities.

It is obvious from these data that post-harvest and prestorage treatment of fruits would be able to extend the storage life of mangoes even under ordinary conditions. Thus there is a possibility of extending the time available for marketing fruits and reduce losses in handling. It is, however, necessary to find out a combination of such growth regulating substances which would slow down the ripening of the edible portion without changing the pattern of colour change of the skin.

The authors are thankful to Dr V. Subrahmanyam Director of the Institute, for his encouragement and guidance.

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STRIP PACKAGING OF HYGROSCOPIC TABLETS

Flexible packaging materials have introduced great changes in packaging pattern of various commodities. The conventional glass bottles and aluminium containers for packaging tablets have certain disadvantages in dispensing tablets in smaller numbers and also exposing the product to moisture and external contamination, when periodically opened. Thus strip packaging whereby each tablet gets the desired protection is becoming increasingly popular. It facilitates dispensing of tablets in smaller numbers. The choice of suitable packaging film or foil is determined by the physico-chemical properties of the tablets to be packed and the shelf-life required for such tablets. Some of the medicinal tablets are highly sensitive to moisture and light. The present study relates to the performance of some commonly available moisture-proof materials for the packaging of hygroscopic medicinal tablets made out of extracts of herbs, etc., marketed by pharmaceutical firms.

In order to assess the degree of protection necessary for the product, humidity-moisture relationships of the freshly made tablets were studied by exposing them to various relative humidities ranging from 40 to 90 per cent in chambers containing appropriate saturated salt solution¹. The samples were periodically weighed and examined for their appearance and marketability.

The results are presented in Table I. These studies indicated that even with a pick up of moisture as low as 0.4 per cent, the product loses its shine and becomes unmarketable, indicating that these tablets are extremely sensitive to moisture changes. In view of the above fact and also taking into consideration the climatic conditions in the sales area the MSAHT* cellulose film and heat sealable aluminium foil appeared to be the suitable packaging materials for this purpose. Accordingly MSAHT cellulose film (300 gauge) and heat sealable aluminium foil (0.025 mm.) were used in these investigations. The tablets strip packaged by the firm on their automatic machine with the above packaging films, were subjected to storage trials at various

TABLE I. Humidity-moisture relationship of tablets at room temperature

Relative humidity %	Moisture pick up or loss %	Period in days to reach equilibrium moisture content or loss of marketability
40	...	Marketable even after 56 days
56	...	...
63	...	...
75	0.4	9
80	0.4	5
85	0.7	1
92	17.1	1

* The MSAHT cellulose film is defined as moisture proof, heat-sealable, anchored resistant to blocking in humid atmospheres and transparent form.

humidities, namely 75 per cent, 85 per cent and 92 per cent at a temperature of 76-80°F and were periodically weighed and examined, for their marketability. The results show that in all the three conditions of storage there is no moisture pick up by tablets packed in aluminium foil. On the other hand, tablets packed in MSAHT cellulose film showed a shelf-life of 2, 9 and 37 days at 92 per cent, 85 per cent and 75 per cent relative humidities respectively, thus indicating that as the humidity in the storage atmosphere increases the efficiency of the cellulose film package decreases. In order to confirm the above observation the water vapour permeability of the cellulose film was determined at 75 per cent and 92 per cent relative humidity at 100°F by the Patra method³. The data obtained show that with the increase in relative humidity in the ambient atmosphere, the water vapour transmission rate increases from 6.9 g. to 10.9 g./sq. meter/24 hours thereby rendering the packaging material less effective under higher humidity conditions. The moisture pick up of the packaging materials was also determined at various humidities. The results given in Table II indicate that cellulose film itself absorbs water vapour under humid conditions thus making it unsuitable. Since heat sealable aluminium foil is unaffected under humid conditions, it seems to be the most suitable packaging material for such highly moisture sensitive medicinal tablets.

In order to confirm the above observations, tablets packaged in aluminium foil were subjected

TABLE II. Percentage moisture pick up of MSAHT cellulose film at different relative humidities

Relative humidity %	MSAHT film
40	-0.8
52	+0.8
63	+3.0
75	+8.7
80	+11.3
85	+19.2
92	+28.4

to rigorous storage conditions, *viz.*, 100°F and 92 per cent R.H. for a period of six months and at 75°F and 75 per cent R.H. for a period over one year and the tablets were intact in both these conditions. Thus aluminium foil would give the desired shelf-life to the product under any climatic condition. In addition the aluminium foil also gives protection against light.

The authors are thankful to Dr V. Subrahmanyam, Director of the Institute, for his keen interest in these studies. We are obliged to Messrs Himalaya Drug Co., Bombay for kindly supplying the experimental samples.

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Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during June 1960 are given in this section.

S (IS) 17

Studies on the utilization of wet-retted and sun-dried coconut pith and husk for the preparation of insulation and the like materials, by B. Anandaswamy (June 4, 1960).—India imports a fairly large quantity of different types of insulating materials. Studies carried out so far in the country have shown the possibilities of using agricultural residues for thermal insulating purposes. Our country being predominantly an agricultural country offers large quantities of different types of agricultural residues most of which are not finding much use at present.

In view of these, investigations were carried out on a number of agricultural residues to find out their suitability for making thermal insulation boards, pads and liners. Among the several types of materials tested, coconut pith obtained during wet-retting of the husk and sun-dried whole husks were quite promising. 3,50,000 tons of wet-retted pith and 1,500 million dried husks are annually produced in the country which do not find much use at present. While investigating the properties of these materials, it was observed that wet-retted pith contains 18 per cent of fine sand. The removal of sand is necessary before further processing. It can be effected either by floatation process or by means of pneumatic separation. The details of the methods were explained and it was pointed out that the sand content could be reduced to 1.8 per cent in the case of floatation method and to 1.5 per cent by pneumatic separation. Data concerning some of the physico-chemical properties of the materials were presented and it was pointed out that these compare well with granulated cork

in bulk density and thermal conductivity.

The procedure for preparing boards was explained in detail and the different types of binders used for the purpose were mentioned. The boards thus prepared had a bulk density of 12–14 lb. per cubic foot, 7–8 per cent moisture and a thermal conductivity of 0.2264–0.2755 of B.Th.U. (B.Th.U. expressed as $\text{Btu hr}^{-1}, \text{ft}^{-2}$ in $^{\circ}\text{F}^{-1}$).

Data regarding other properties such as thermal conductivity, modulus of rupture, bulk density at different temperatures and R.H. per cent were presented. The speaker revealed that boards produced by the above process compared well with the imported cellulose boards. The possible use of the pith and fibre boards in ice boxes was also mentioned.

Supplementing the talk, Mr N. V. R. Iyengar said that this investigation arose as a direct result of the earlier experiments carried out on a long distance transport studies on perishables where the necessity of insulating the railway wagons was felt. Cork which is normally used for this purpose has to be imported and it was therefore felt to find a suitable substitute for this purpose. He gave details of the trials carried out so far with different types of agricultural residues and their drawbacks for this purpose. He also dealt with the economics of the production of coconut pith and fibre boards and referred to the work in progress at the Institute on termite and water-proofing of these boards.

Some of the salient points raised during the discussion were: prevention from mould and termite contamination, economy of utilization, collection of pith, resistance to shocks, reasons for the difference

in the nature of wet-retted and sun-dried pith, capacity of pneumatic separator, bleaching of pith, chemical nature of pith, ash content of pith, cost of insulation board and its efficiency over other available synthetic insulating boards now being manufactured in the country, use of hard coconut shell, reduction of moisture content, avoiding injuries from moisture leakage, complete separation of sand from pith, utilization of pith in Mysore State, problem of fish transportation, etc.

Answering the questions, Major Iyengar said that the firm to whom the process has been leased out for commercial exploitation, are confident of selling it at reasonably lower prices than those of any other similar material. Further, he said that work is in progress in making the board termite-, mould- and moisture-proof. He also gave an account of the method of collection of pith. The average capacity of the experimental pneumatic separator is 0.5 Kg. per minute.

The President, in his concluding remarks, said that further work is necessary to make the boards resistant to any type of attack such as termite, mould infestation, etc. He stressed that the boards thus prepared should not develop any off-flavours during usage. Work on use of binders for incorporation which will resist the attack and can withstand drastic states and impart some other useful properties should be taken up. Efforts should also be made to find out some insulating material which will be stable and very economical so that it can be used by all people. He suggested that the insulation boards prepared can also be sent to the Central Building Research Institute for large-scale trials for use inside the

building for air-conditioning and other similar uses.

S (IS) 18

Through-flow drier, by S. S. Kalbag (*June 20, 1960*).—Hot air drying is one of the least expensive and the commonest methods of drying. The air, in drying, has a two-fold function, *viz.*, to supply heat to the material and to carry away the water vapour produced. To the extent that a faster supply of heat and a quicker removal of water vapour can enhance the rate of drying, the design of the drier can be considered responsible for the drying rate. But a stage is ultimately reached when the drying rate cannot be further increased by increasing the rate of supply of heat and removal of water-vapour. It is, therefore, necessary to consider all the factors governing the rate of drying and to understand the limitations of drier-design.

When a material is being dried in air, the drying rate may be controlled or limited by either of two factors. The drying rate may be limited by the rate at which moisture is evaporated off the surface or it may be limited by the rate at which moisture can diffuse from the interior to the surface. In the former case, the factors governing the rate of evaporation from the surface, also determine the rate of drying. Since the evaporation of water from the surface is dependent solely on the drying conditions, the drying rate is constant as long as the drying conditions are steady. This is known as the constant rate period of drying. In the other case, the diffusion of moisture from the interior to the surface, governs the rate of drying; the rate of diffusion of moisture is governed mostly by the nature of the material and the temperature at which it has to be dried. In this case, the drying rate continuously drops down as the diffusion of moisture slows down. This is known as the falling-rate period. The moisture content of the material when it goes over from the constant rate period to the falling

rate period is known as the critical moisture content. It is obvious that the drier design could affect the rate of drying in the constant rate period only.

In the falling-rate period of drying, the drier design aims at simplicity of the drier and the minimum expenditure of energy. Thus, through-flow driers (*e.g.* bin driers) with air at very low velocity are used for the final drying of vegetables. The report discusses the design of a drier, wherein the through-flow of air at high velocity is advantageously used for a high drying rate in the constant rate period.

The rate of surface evaporation, which is also the rate of drying, in the constant rate period, is directly proportional to the driving force and inversely to the resistance. Since this surface evaporation must involve the flow of heat to the material and the flow of water-vapour away from the material under equilibrium conditions, they should be equivalent to each other. It would be sufficient therefore for us to consider the flow of heat from the air to the material. This rate of heat transfer is dependent on the film-coefficient, the area and the temperature gradient. The drier design therefore aims at increasing this film heat transfer co-efficient, as the other two factors are largely independent of the design.

If we calculate the film co-efficients for cross-flow and through-flow systems, we find that as the velocity of air increases, the difference between the two systems diminishes, but is very much in favour of the through-flow system for all practicable air velocities.

The advantages of a through-flow drier are: (a) quicker drying, (b) less expensive equipment and (c) less labour for loading and unloading. The disadvantages are: (a) only some materials can be handled in a through-flow drier, (b) the drop in pressure across the material is larger; hence more energy is required to force the air through, (c) the drier offers less flexibility in load—it cannot dry properly if the

load is more or less and (d) the air velocity may carry off the material. To a certain extent, this may be avoided by sending the air downwards through the material bed but this may pack the material more compactly and increase the resistance to the flow of air.

After small scale trials on a laboratory through-flow drier, the design was drawn up along the following lines: A maximum air-velocity of 3-4'/sec. was chosen for the drier as most of the materials encountered had a greater critical air-velocity. From the known pressure drop for the various materials handled before, a 6" bed was considered the maximum necessary. The bed area was chosen as 6.25 sq. feet (2.5' × 2.5') to give a capacity of approximately 3 c. ft. of material per tray. From the area and the velocity, the capacity of the fan was calculated to be 1,500 c. ft./min. Next, a general layout was made in which provision was made for air-recirculation. Controls were provided for air-recirculation and air-velocity by suitable dampers. Pressure drop was calculated for the ductwork and the drier, for the above fan capacity. Thus the specifications for the fan were arrived at. Because of the easy availability of centrifugal blowers producing the required 1,500 c. ft./min. at 3" S.W.G. pressure, the centrifugal blowers were selected in preference to impeller-fans in spite of their lower efficiency. The heater capacity was then calculated to provide for heating all the fresh air to 70°C with no recirculation. Both electric open coiled-coil and finned steam-tube heaters were designed with flanged connections so that they would be interchangeable.

Manometers were provided for measuring the pressure drop across the material and across the heater. Thermometers were provided for measurement of air temperatures at three points. The pressure and temperature differential across the bed of material help to indicate the state of drying. The pressure drop across the heater indicates the

approximate air-velocity being used. The pressure drop across the material gives information about the air-velocity and also gives an indication if channelling of air should occur.

The cabinet was made up of steel angles with wooden sides lined inside with asbestos sheets and measured 2.5' in all dimensions. The material is carried in two separate trays in the form of drawers each measuring 2.5' x 2.5' x 6". The bottom of each tray is of course perforated. The trays are interchangeable and are situated one below the other with a clearance of 6" in between. The purpose of this is to be able to carry out the drying in two counter current stages. Thus the top tray is always filled with the fresh wet material, while the lower tray holds the partially dried material. The hot air thus passes through first the partially dried

material and consequently picks up only a little of the moisture with a slight lowering of temperature. The air, with most of its drying capacity still in tact, then passes through the wet material and leaves the drier with the maximum amount of moisture and minimum of sensible heat.

The data on the drying time for several materials were presented. This was collected by the members of staff from different Divisions working with different materials.

The important points raised during the discussion were: possibility of employing the through-flow drier for phased drying of certain materials, use of dehumidifiers for reducing the high R.H. during rainy season, effect of quick drying on the flavour of the products, storage behaviour of the dried products, determination of moisture content of the material in the tray

by the temperature and pressure drops, prevention of cracking of arecanuts during drying in the through-flow drier, use of corrugated bottom for the tray instead of flat bottom, need for making the drier workable commercially and economically in villages, possibility of using an inert gas in place of air for drying shrimp to prevent flavour loss, etc.

Commending the paper as an interesting one, the President said that for materials sensitive to heat, other methods or modification of the drying technique should be thought of. The post-storage life of the dried material has to be determined and the quality of the product assessed. The critical moisture content has to be determined. He concluded by saying that emphasis should be laid on the quality of the resultant product.

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Spoilage of pickles

E (IS) 53

I sometimes find the spoilage of pickles by germs. I request you to let me know whether they originate from the eggs present in the vegetables and develop due to improper method of preparation. (Trichur).

The spoilage of pickles is not simply a chemical or physical change resulting from the action of heat or air but it is more often the result of a number of actions or developments taking place. Fermentation, decay, souring are all due to the action of micro-organisms. The quality of the raw material, the sanitary environments, proper

precautions at each step of pickling, use of proper sanitary containers, and proper storing places are all important factors in maintaining the good quality of the pickles. It is true that the formula for the pickles is more or less the same but the quality will depend upon the factors as mentioned above. It may happen that in a lot of mangoes the spoilage may occur in the same varieties plucked at different periods and under different conditions.

Golden syrup

E (IS) 54

I request you to kindly enlighten me as to the manufacturing processes involved in making golden syrup.

With regard to golden syrup the following is the formula for its production:

Sugar	...	87 lb.
Water	...	2½ gal.
Tartaric acid	...	38½ g.
Sodium bicarbonate	...	38½ g.
Caramel colour	as desired.	

Mix sugar and water and heat to boil. Add tartaric acid and remove the scum. When the syrup becomes clear, add sodium bicarbonate. Now heat to 80° Brix, allow it to cool to 170° F, add caramel colour and fill the syrup in cans at 160° F.

Golden syrup is also made by mixing mother liquor obtained after the second or third massecuite

stage in the refining of sugar with invert sugar.

The composition of golden syrup is as follows:

Total sugar	... 68.5%
Invert sugar	... 37.5%
Sucrose	... 31%
Water	... 22.5%
Ash	... 3.9%

Chemical composition of molasses and gooseberry

E (IS) 55

I would request you to let me know the food value and composition of Indian molasses and gooseberry. I would also like to know which Indian vegetable has the maximum quantity of B-vitamins. (Alleppey).

The composition of Indian molasses and that of gooseberry are given below:

Chemical composition of Indian molasses

Total sugars (as invert sugar)	50.0%
P ₂ O ₅	... 0.1%
K ₂ O	... 3.6%
CaO	... 1.4%
Total carbon	... 30.1%
Total nitrogen	... 0.3%

Chemical composition of gooseberry (Nellikai—*Phyllanthus emblica*)

Moisture%	... 81.2
Protein %	... 0.5
Fat (ether extractives) %	... 0.1
Mineral matter %	... 0.7
Fibre %	... 3.4
Carbohydrate %	... 14.1
Calcium (Ca) %	... 0.05
Phosphorus (P) %	... 0.02
Iron (Fe) mg. %	... 1.2
Calorific value per 100 g.	... 59
Vitamin B ₁ , µg. per 100 g.	... 30
Nicotinic acid, mg. per 100 g.	... 0.2
Riboflavin, µg. per 100 g.	... ...
Vitamin C, mg. per 100 g.	... 600

Vegetables in general are not good sources of vitamins of the B group. However, vitamin B₂ called riboflavin is present in amaranthus, spinach and fenugreek leaves.

Ripening of bananas

E (IS) 56

We desire to have the details of the method of ripening bananas uniformly. The flavour should not be impaired by the ripening treatment. (Bombay).

As regards the ripening of bananas uniformly, we suggest to you to have an insulated air-tight room with proper ventilation, preferably with the aid of an exhaust fan to operate when necessary. The temperature should be maintained at 62-68° F. and relative humidity round about 80-85 per cent. Bunches of bananas should be properly stacked by arranging them vertically or hanging them by rods or ropes. Dried banana leaves which also contain ethylene can be burnt in the room so as to create sufficient smoke which will further help in even ripening. Ethylene alone can be used but even ripening of the pulp. This will also enable to make the bananas more sweet. If it is necessary to delay ripening process the bananas can be stored prior to ripening at 52-55° F. and relative humidity of 80-85 per cent for a period of 3 weeks, after which they can be ripened as usual in the air conditioned temperature. Ripening time in that case will be about 2-4 days.

Manufacture of biscuits

E (IS) 57

We are manufacturers of quality biscuits, sweets and toffees. We are most successful in preparing sweets and toffees but we failed to satisfy our customers in the matter of biscuits. We shall therefore be grateful if you could kindly furnish full details of the manufacturing process for biscuits giving the nature and proportion of materials used, different types of colours and essences used in different types of biscuits, temperature of the baking oven, etc. (Ahmedabad).

The steps involved in manufacturing biscuits are: mixing of the flour and other ingredients to make a dough which is not too tough, rolling the dough into thin sheets, then cutting into different shapes with different types of cutters as desired, placing them on clean baking trays and baking in an oven at definite temperature for a definite period depending upon the type of the biscuit. In modern units, all these operations are done automatically and the quality of

every ingredient is also checked. The basic materials used in the dough are flour, baking powder, fat, milk or water, sugar and/or salt.

As regards the amount of materials to be mixed in, you should let us know the type of biscuit you are interested in manufacturing so that we might be able to help you in the matter. Regarding colours and essences, all harmless edible food colours and essences permitted by law can be used. The colour and the essence will also depend upon the particular type of biscuit. Vanilla flavour and the caramel colour are most common.

The temperature of the furnace as well as the time of baking vary with the type of the biscuit to be prepared. The range is from 350° to 500° F. with a baking time of 3-7 minutes.

We would like to know the procedure you are adopting for manufacturing biscuits at present and the equipment used so that we might be able to help you in solving your difficulty.

Fatty acid composition of oils

E (IS) 58

Could you please help me by sending data on the fatty acid composition of peanut and sesame oils? Do you have any information as to the make-up of Hall's home salad oil which can be purchased in most shops? (Ludhiana).

The composition of fatty acids present in peanut oil and sesame oil is given below:

Fatty acids (Wt.%)	Peanut oil	Sesame oil
Palmitic	... 8.3	9.1
Stearic	... 3.1	4.3
Arachidic	... 2.4	0.8
Behenic	... 3.1	...
Lignoceric	... 1.1	...
Oleic	... 56.0	45.4
Linoleic	... 26.0	40.4

We have not done analysis of Hall's home salad oil and therefore we will not be able to say anything in the matter.

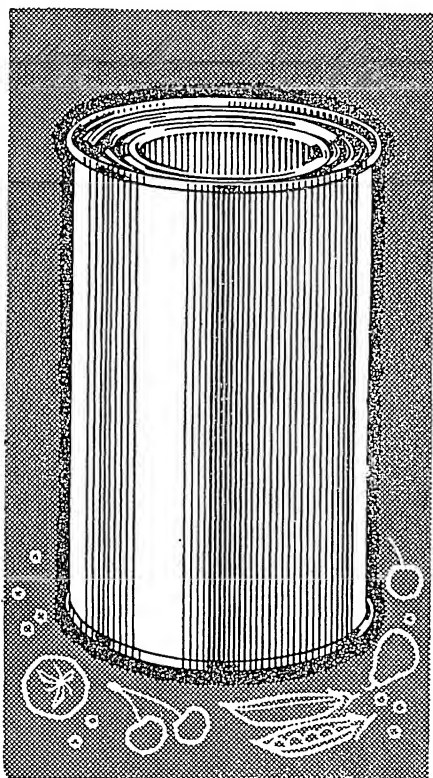
Rennet*E (IS) 59*

I shall be thankful to you if you can kindly throw some light on rennet and its method of preparation. (Amritsar).

Rennet is an enzyme produced in the stomach. It is especially abundant in the young while still

suckling. Rennet is usually prepared from the fourth stomach of the calf. The stomachs are dried and kept for some time. They are then cut into small pieces and macerated in a 5 per cent solution usually containing boric acid for some days. To the solution, a further 3 per cent of salt is added and the liquid filtered; this forms

extract of rennet. By adding more salt, the rennet is precipitated and 'rennet power' is produced. This consists essentially of the ferment together with other organic matter and a considerable amount of salt. The activity of the rennet is destroyed by alkali. Like all enzymes it has an optimum temperature at which it acts best.

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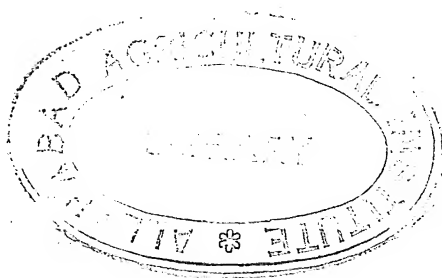
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Notes and News

STATISTICAL NOTES

Production figures of Food Industries during January-April, 1960

Name of Industry	Unit	January 1960		February 1960		March 1960		April 1960	
		No. of units reported	Production	No. of units reported	Production	No. of units reported	Production	No. of units reported	Production
1. Biscuits ...	M.T.	29	1669	27	1723	23	1655	25	1653
2. Confectionery ...	M.T.	37	1441	35	1270	33	1286	30	994
3. Flour Milling ...	M.T.	54	81999	55	83593	55	95141	52	81759
4. Butter ...	M.T.	5	221.43	5	179.48	4	173.13	5	115.58
5. Cashewnuts ...	M.T.	10	978	9	984	8	1185	9	1222.83
6. Gram flour & Dal ...	M.T.	1	471	1	470	1	378	1	491
7. Aerated water ...	Gross bottles	28	48282	24	63006	24	74532	28	107668
8. Cigarettes ...	Million pkts.	15	2960	15	2935	15	2965	14	2708
9. Beer ...	Litre	2	576988	2	704481	2	1010157	2	861132
10. Indian made Foreign liquor	Litre	20	228215	18	210205	16	137515	20	195152
11. Country spirit ...	Litre	17	1494818	17	1360239	19	2000750	15	1227639

NEWS BRIEFS

Fungal amylases in flour: 'Diastatic activity' is an important property of flour and can be considered to be dependent on two main factors: (a) the susceptibility of the starch in the flour to attack by amylolytic enzymes which may be naturally present in the flour or added and (b) the amylase content of the flour.

Amylases, the enzymes which catalyse the hydrolysis of starch, are generally classified into two main types, alpha- and beta-amylase. The saccharogenic or sugar-producing enzyme, beta-amylase, is usually present in sufficient quantities in flour. Alpha-amylase, the starch liquifying and dextrinogenic enzyme, is however, present in very small amounts in flour milled from sound wheat but increases with the degree of sprout. Flours deficient in diastatic activity may be supplemented by the miller or by the baker and the traditional diastatic supplement is malt flour.

In recent years, amylases derived from fungal sources have been increasingly used to improve the diastatic performance of flour. Such products are prepared in the form of highly active powders which may be diluted by the manufacturers

to produce materials of uniform strength which have certain advantages. Purified fungal amylases have been accepted in the U.S.A. as ingredients of bread and rolls.

Fungal amylases are being increasingly used as flour additives. As the methods normally used in the examination of flour do not reveal the presence of these materials, a technique has been developed which may be employed for their detection and semi-quantitative estimation.

The decrease in alpha-amylase activity which occurs when a flour extract containing calcium ions is heated at 68°C. for 30 minutes may be employed for the detection and estimation of fungal amylases in flour. Confirmation of the presence of fungal amylase and of the amount which has been added to flour can be obtained by using the relationship between cereal alpha-amylase activity and Hagberg number (*British Baking Industries Res. Assoc. Report.*)

New improved crystal inhibitor for edible and non-edible oils and oil products: Claricol, a new phenomenal crystal inhibitor, for use in extending the Cold Test of edible and non-edible oils and oil products and, for use in winterizing these

oils, is announced by Beacon Chemical Industries, Inc., of Cambridge, Mass. The use of Claricol assures that salad oils, cooking oils, mayonnaise, and salad dressings remain crystal-free longer under colder conditions. Claricol has no effect on flavour, stability, colour and smoke point.

Test results show Claricol has amazing crystal inhibiting powers. A.O.C.S. Cold Tests reveal the addition of Claricol in very small quantities inhibits the precipitation of solid fat crystals at low temperatures. As little as 0.03 to 0.04 per cent Claricol added to cottonseed salad oil quadruples the A.O.C.S. Cold Test on a typical oil. Cold tests of 50 to 100 hours are common when Claricol is used.

Even more dramatic than the extension of the A.O.C.S. Cold Test is the fact that Claricol's inhibiting power limits eventual crystals to imperceptible size—no heavy floc.

Adding as little as 0.02 to 0.04 per cent Claricol to refined cottonseed oil prior to winterizing, speeds up crystal precipitation and overall production. Oils containing Claricol are more easily and rapidly filtered. The yield of winterized oil is increased and the Cold Test of

the resulting oil is markedly improved.

Claricol is semi-fluid, easy to handle, and very economical (*Beacon Chem. Industries Inc. Report*).

Waves keep frozen milk fresh:

It is now possible for anyone in any part of the world to enjoy a glass of 'fresh' milk as a result of a recent British discovery whereby freshly pasteurized whole milk is subjected to a special ultrasonic treatment before being quick-frozen under controlled conditions. The process comprises of five main steps, viz., pasteurizing the milk either by batch or continuous process, treating it thereafter for five minutes ultrasonically with radiations having a frequency of one megacycle/sec., filling the treated milk immediately into suitable containers, placing the filled containers in a freezer at 20°F. and finally storing the frozen product at temperature below 10°F. The ultrasonic process overcomes separation on thawing, protects flavour and extends shelf-life indefinitely. The new process is now in commercial operation in Britain and the product is said to have a growing demand (Abstracted from *Food Engng.*, February 1960, p. 85).

Radiation detector measures fat in meat: A new type large volume scintillation counter at USDA's research center in Beltsville, Md. measures gamma ray emissions that occur naturally from K-40 present in animal tissue. Since most of this isotope occurs in muscle tissue instead of fat, number of impulses gives an accurate measurement of the proportion of fat to lean meat.

Detector was developed for AMS to use in work of establishing more objective measurements of food quality. Agr. Research Service is co-operating in work on meat.

One of the major advantages of this method is that, unlike chemical analysis, it provides a nondestructive estimate of lean and fat content. Preliminary work has shown that the machine gives a high degree of accuracy.

Equipment consists of two basic units: (1) A 13,000-lb. detector, and (2) two counter—one to measure potassium, the other cesium-137. Meat is placed on a trough in detector and sealed in a central well 14 × 24 in.

Radiation given off activates a plastic scintillator around the well which transforms the activity into faint light flashes.

These flashes are magnified by 8 photomultipliers attached to the scintillator, then passed along to the counter in form of electric impulses. Number of impulses in given time is proportional to amount of fat.

Counter will be used to provide basic information in difference in K content between muscles in an animal, different animals, and different species of animals. It could be designed to reject automatically any piece of meat that had too much fat for a given grade (*Food Engng.*, February 1960, p. 105).

Gas chromatography detects fat adulterants: Fat mixtures can be readily analysed for their component fatty acids by means of gas chromatography. However, it is necessary to hydrolyze the fats, and to convert the fatty acids to their volatile methyl esters.

When sample (one microliter) is injected into gas stream of chromatography unit, a characteristic graph showing peaks for each fatty acid appears on the chromatograph charts. Such charts have demonstrated presence of fatty acids in fats, not previously known to exist in them, a 20-carbon acid in cocoa butter, for example.

Presence of foreign fats such as palm kernel or coconut oil in cocoa butter can be detected at levels as low as 2 per cent. Curves for pure cocoa butter and substitutes differ clearly in position or height of peaks, sometimes in both (*Food Engng.*, February 1960, p. 110).

Tomato powder: Successful production of tomato powder is being undertaken by a processing company located in the community of Puy Saint-Reparate, France. The tomato is first turned into a

liquid concentrate and then atomised in a heated atmosphere, which process turns it into powder retaining all the colour and qualities of the whole tomato. The end product has excellent keeping qualities and can be used in all recipes calling for tomatoes or tomato paste. The factory producing this item, which is on a 24-hour production schedule, is presently supplying 90 per cent of its output to the export market (*Austr. Food Manuf.*, April 5, 1960, p. 80).

New quick-frozen baby foods:

From America comes news of a new type of frozen food—instant baby meals produced from dehydrated food crystals. The foods—vegetables, soups, dinners and fruits—consist of free-flowing crystals which can be made ready for serving, without thawing, by stirring in hot or cool water.

Like conventional frozen items, the new foods can be stored indefinitely in freezer compartments of refrigerators. In addition, unlike usual frozen items, it is claimed that they can be kept for upto a month at normal refrigerator temperatures. Also, the new process is said to allow a high degree of retention of nutrients, flavour and colour (*Austr. Food Manuf.*, April 5, 1960, p. 80).

Synthetic antioxidants in fats:

Thin-film chromatography, using films of silica-gel, is used for the detection of synthetic antioxidants in fats, using one-directional with CHCl_3 as a solvent, or two-directional systems with CHCl_3 and benzene as solvents.

After separation the film is sprayed with phosphomolybdic acid reagent, when the separated antioxidants appear as blue spots. Other developments include the exposure of phosphomolybdic acid-treated films with ammonia vapours, 2:6 dichloroquinone chloroimide/ethanol solution, either neutral or sprayed with a borax/ethanol solution, and also diazotised sulphanilic acid. The method is described as being applicable to commercial methods (*Food manuf.*, March 1960, p. 123).

Stabilising flavour of milk products: A process for stabilising the flavour of milk fat products, especially dried whole milk, has been developed in the U.S.

Although dried skim milk may be stored without refrigeration for long periods without losing its fresh quality, dry whole milk develops storage flavours which make it unacceptable as a substitute for fresh whole milk.

Such objectionable flavours can be prevented, it is claimed, by subjecting separated milk fat to steam action under high vacuum to eliminate the lactones and other objectionable substances.

The method involves flushing steam through milk fat under high vacuum at high temperatures. The fat can then be re-emulsified into skim milk and dried to yield a whole milk with improved flavour quality. This product can be stored under nitrogen to maintain a satisfactory flavour without refrigeration for over six months.

In addition to its use in dry whole milk, the flavour stabilised milk fat can be used in such products as dried ice cream mix and dry cream powders, while the condensed by-products of the steam treatment are said to provide a flavour concentrate of a butter or butterscotch quality which can be used to flavour other foods (*Food Manuf.*, March 1960, p. 130).

Rising Indian biscuit and confectionery production: Production of biscuits in India increased from 12,500 tons in 1950 to 17,702 tons in 1958. Output of sugar confectionery improved during the same period from 8,200 tons to 10,212 tons.

The trend of biscuit and confectionery exports is rising. They went up from 2,000 cwt. in 1957 to 3,000 cwt. in 1958. During the first nine months of 1959 they were 2,000 cwt. as compared to 1,500 cwt during the corresponding period of 1958.

The main customers for confectionery and biscuits were Singapore, Hong Kong, Bahrein Islands,

Ceylon, Aden, Kenya, Kuwait and Saudi Arabia (*Food Manuf.*, March 1960, p. 131).

ISI mark for aerated water glass bottles: The Indian Standards Institution has granted a certification mark licence to M/s. Mahalakshmi Glass Works Private Ltd., Haines Road (West), Jacob Circle, Bombay-11 to use the standard mark in respect of aerated water glass bottles, manufactured in accordance with IS:1107-1957. This is the first licence in respect of this product.

The relevant standard mark will be impressed on each bottle.

The presence of the standard mark, a third-party guarantee, will convey an assurance to the purchasers that the bottles have been manufactured under controlled conditions and are of the quality as laid down in the relevant Indian Standard.

Any complaint about product bearing the ISI mark may kindly be brought to the notice of the licensee as well as this Institution (*ISI Press Note No. 243/60.*)

NEW INDIAN STANDARDS

Baker's yeast: Baker's yeast is used for the leavening of baked goods. Usually, it consists of 'top yeasts'—so called, because they ferment at the top of the substrate. It consists of *Saccharomyces cerevisiae* and related species. In the trade, it is available either in the compressed form or in the dried form.

The Indian Standard Specification for Baker's Yeast (IS: 1320-1958) prescribes requirements and methods of test for two types of the material, namely (1) Baker's Yeast, Compressed (BYC), and Baker's Yeast, Dried (BYD).

Endrin emulsifiable concentrates: Endrin emulsifiable concentrates, containing varying percentages of endrin, are largely used in the control of insect pests of agricultural importance.

The Indian Standard Specification for Endrin Emulsifiable

Concentrates (IS: 1310-1958) which prescribes requirements and methods of test for the material, has been prepared to facilitate the supply of endrin emulsifiable concentrates of a quality most suitable for use under subtropical and tropical conditions (*ISI Bull.*, March-April 1960, p. 110).

FOREIGN PATENTS

2,912,335. Ultrasonics plays big roll in egg freezing process: Preserving shell eggs by a special freezing process is aim of a recent patent. Method comprises arranging the fresh eggs in a special rack and vibrating them at low, audible frequencies for 2 hr. at -10F. Eggs are then stored in a freezing environment until used (*Food Engng.*, February 1960, p. 105).

2,903,371. Inert gas guards flavour of concentrated juice: An improved process for preparation of concentrated citrus juices, that employs successive stages of freezing and removal of ice crystals in an atmosphere of inert gas is the object of a recent patent.

Device comprises fully enclosed agitator-equipped refrigerated tanks each with associated centrifuge mechanism, plus means of supplying and circulating inert gas to them.

In operation juice is fed to first tank where it is cooled and agitated to form ice crystals. Simultaneously, gas is introduced through a perforated ring in tank bottom and moves upward to purge CO₂ from the juice, then form a blanket above it. A portion of this gas is then recirculated.

Mixture of juice and crystals drops through special dual valve into centrifuge where (in an atmosphere of the inert gas) ice crystals are removed. Concentrated juice then flows to next freezing tank where more ice crystals are formed and subsequently separated. Steps are continued until desired concentration is effected (*Food Engng.*, February 1960, p. 106).

2,911,303. Non-sticky peanut butter: Stabilized peanut butter

that has good palatability, smoothness, and spreadability over a wide temperature range is the object of a recent process.

Crux is adding to the ground nuts a dispersion of fully hydrogenated fat in unsaturated liquid oil. (Amount of dispersion should equal 10-25 per cent of final product.) Then butter is cooled to 75-80°F. and packaged.

Preferred fats are: A cottonseed stearine with titer of 137-43°F., and cottonseed oil, with iodine value of 110, free fatty acid content 0.02, peroxide value negative. Dispersion comprises 13-18 per cent stearine in 82-87 per cent oil. It is prepared by introducing stearine in the oil and heating to 140°F. with agitation to produce substantially crystal-free liquid (*Food Engng.*, February 1960, p. 109).

819,078. Chiffon dessert preparation: A dry mix which can be readily dissolved in water or other aqueous liquid and whipped into a stable chiffon dessert preparation suitable for use as a pie filling or

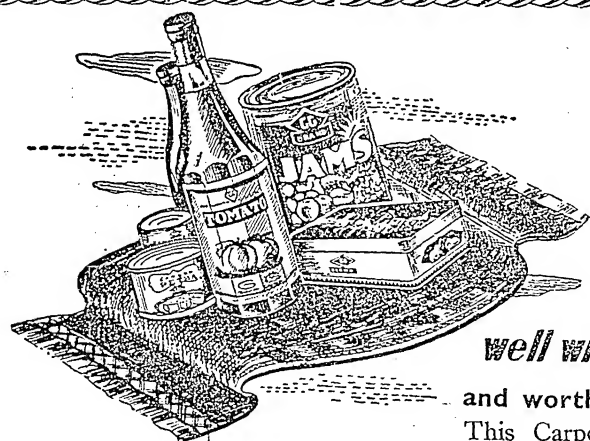
similar dessert, is obtained by employing partially degraded soya protein, gelatine, and pre-gelatinised starch in combination as a whipping material to be dissolved with a sugar such as sucrose in an aqueous liquid. The partially degraded soya protein provides a very fine textured foam with good overrun after a short whipping, and the gelatine acts to set the fine foam and provides body and stability (*Food Engng.*, February 1960, p. 94).

819,097. Container cover: A container for frozen food and other products requiring protection against moisture loss and gain, loss of flavour and freshness, is provided with a lid made of metal foil and having a tear strip formed by opposed weakened lines, and a plastic film bonded to the foil on the underside of the tear strip: during opening the severed edges are brought upwardly into a corrugated form which prevents any finger or hand laceration in handling the cover at the cut edges.—Patented by Reynolds Metal Co. 1960, p. 96)

(*Food Trade Rev.*, March 1960, p. 94).

826,250. Meat products: In a process for producing a strained meat product, such as baby food, the protein content of the product being filled into containers is partially coagulated prior to cooking in order to reduce clumping which tends to give the product an unsatisfactory curdled appearance—this reduction is probably due to the fact that denaturing of the protein content during coagulation prevents further denaturing when the product is cooked.—Patented by Gerber Products Co. (*Food Trade Rev.*, March 1960, p. 96).

821,277. Preserving: Perishable products, e.g., fruit and vegetables, are coated and/or superficially impregnated by applying thereto an alcoholic solution containing from 4 to 11 per cent by weight of shellac, thereby to protect the product against mould and other causes of natural decay.—Patented by G. F. Kher (*Food Trade Rev.*, March 1960, p. 96)



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A G R A



Information from Foreign Journals

THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

GERMAN

FETTE SEIFEN ANSTRICHMITTEL

March 1960, Vol. 62, No. 3

- Paper chromatography in the field of fats. XL. PAGE
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Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Observations on the rate of dehydration of root vegetables in heated air, by Bhatia, B. S., Tucker, C. G. and Gooding, E. G. B., *J. Sci. Fd. Agric.*, 1959, 10 (2), 130.—A four stage counterflow hot-air drying system with interstage reheating which has been developed for the dehydration of vegetables in strip or shred form is compared with a less complex system of fewer stages for drying strips of scalded carrot or potato. Satisfactory drying is possible in some cases in 6-7 hours even in a single-stage system, though not necessarily with good thermal efficiency. The possibility of bacterial hazards associated with low initial drying temperature is discussed.

Preparation of some useful preserved products from Carambola (*Averrhoa carambola*), by Siddappa, G. S., *Indian J. Hort.*, 1959, 16 (1), 47.—Carambola is one of the important minor fruits grown in South India and two varieties are generally available in the local market, one of them being far less acidic than the other. The author has standardised methods for the preservation of this fruit. Analysis of the sour and sweet varieties of the fruit gave the following values: yield of juice, 66.7 and 66.0 per cent; total soluble solids in juice at 20°C, 6.5 and 6.5 per cent; acidity of juice as anhydrous citric acid, 1.01 and 0.41 per cent; pH of juice, 1.93 and 3.25 and ascorbic acid in juice 15.4 and 10.4 mg. per cent respectively. Details of the preparation of squash, jam, jelly, preserve and candy are given. All the prepared products were of good quality except the jam which was of fair quality only.

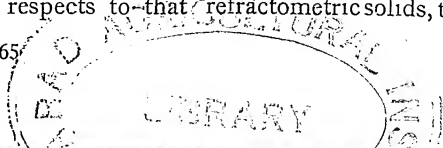
K.L.R.

Canning of dried Bengalgram (*Cicer arietinum*), by Siddappa, G. S., *Indian J. Hort.*, 1959, 16 (3), 170.—The original green colour of the dried green Bengalgram is lost during the blanching in canning process. The addition of the Pea Green colour to the brine does not result in much improvement of colour of the canned gram. Preliminary soaking of the gram in sulphite solution helps in the uniform absorption of green colour added to the brine. Soaking of the gram in coloured water and then canning in plain brine is not, however, effective as regards the retention of colour in the canned products. The soaking of the gram in water acidified with citric acid makes the canned product mucilaginous, but soaking in plain water and then canning in acidified brine gives a non-mucilaginous product. Addition of acid to the steeping water has thus an adverse effect as regards the quality of the canned product. Enzymatic break down of phytin and pectins during steeping under different conditions of pH and the reported inter-relation between these two as regards the texture of the canned product may account for this in a general way.

Physico-chemical composition of passion fruit (*Passiflora edulis*, Sims.) III. Effect of stage of maturity of fruit at picking time, by Pruthi, J. S., *Indian J. Hort.*, 1959, 16 (2), 110.—The physico-chemical analyses of a number of passion fruits (*Passiflora edulis*, Sims.) at three stages of maturity namely (i) yellowish green, (ii) partially purple (iii) purple, revealed that the juice from the yellowish fruits was definitely inferior in almost all respects to that

from the fruits at the other two stages. However, there was no material difference between partially purple and purple fruits except for the better flavour in the latter. The development of purple colour on the skin of the fruit served as a fair index of the degree of maturity of passion fruits.

Physico-chemical composition of passion fruit (*Passiflora edulis*, Sims.) IV. Effect of date of picking and plant-to-plant variations on some physico-chemical aspects, by Pruthi, J. S., Sankaran, A. N. and Girdhari Lal, *Indian J. Hort.*, 1959, 16 (4), 243.—The paper covers detailed data on the nature and extent of variation in physico-chemical composition of purple passion fruits (*Passiflora edulis*, Sims.) as affected by the dates of picking and plant-to-plant variation. Samples of 12 fruits each at intervals of a fortnight in the main season (July—August 1952), were picked from each of the six earmarked plants at the Pomological Research Station, Coonoor (India), and were analysed for fruit components, refractometric solids (°Brix), acidity, °Brix/acid ratio, pH, ascorbic acid, reducing, non-reducing and total sugars. Result of detailed statistical analyses are presented and discussed. Wide variations in some characters have been noted. An overall trend in the changes of the various physico-chemical characters of the fruit as well as juice, based on means of 72 observations at each of the four dates of picking has been illustrated. The results indicated that between the six plants under study, there were no significant differences regarding peel and juice content, refractometric solids, titrable acidity,



°Brix/acid ratio and pH, while in the other physico-chemical characters studied, the differences were significant.

Comparing the four successive dates of picking, during 1952, the differences with respect to all the physico-chemical characters studied were very highly significant (at 0.1 per cent level), except in the case of reducing sugars wherein the differences were not significant. The above results, however, pertain to passion fruits picked from the selected six plants from the same orchard and during one season in a particular year, (1952).

Effect of method of extraction of juice on the development of bitterness in preserved orange juice, by Siddappa, G. S. and Bhatia, B. S., *Food Technol.*, 1959, 13 (7), 349.—Gentle extraction of the juice from Coorg oranges helps in avoiding the incorporation of bitter constituents which are present mostly in the rag and peel of the fruit. Although the yield of the juice can be increased by about 4-5 per cent by heavy pressing, the resulting juice has a tendency to become slightly bitter. The extraction of rag is intensely bitter, but the juice from the sacs only is free from any bitterness. Lye treatments of the segments remove bitterness, but the yield of juice is lower slightly. The retention of ascorbic acid in bottled orange juice is as high as 65-75 per cent during a storage period of one year at ordinary room temperature of 24-30°C. To avoid bitterness in the juice, the method of extraction should be such that very little of rags or peels gets into the juice during extraction. The addition of 5-6 per cent of sugar to the juice helps to mask any trace of bitterness that might still get into it.

A rapid spectrophotometric method for the detection and estimation of adulterants in tomato ketchup, by Beerh, O. P. and Siddappa, G. S., *Food Technol.*, 1959, 13 (7), 414.—A rapid method has been evolved for the estimation of lycopene in tomato products

based on the measurement of absorption at 503 m μ using the petroleum ether extract of the total carotenoids. The replacement of tomato solids in tomato ketchup by such adulterants as carrot, ash gourd, pumpkin, sweet potato, papaya and apple pulps lowers the lycopene content of the product. On this basis, the tomato solids content of the product has been determined by estimating its lycopene content.

Adulterants like carrot pulp increase considerably the β -carotene content of the ketchup. There is very little loss in the lycopene content of tomato ketchups, genuine as well as adulterated, during a storage period of two months at 37°C. A lycopene index of 475 μ g/g. of tomato solids has been tentatively proposed for the estimation of the extent of adulteration in tomato ketchups, when other fruit and vegetable pulps are employed as adulterants.

Preparation of pectin from raw papaya (*Carica papaya*) by aluminium chloride precipitation method, by Bhatia, B. S., Krishnamurthy, G. V. and Girdhari Lal, *Food Technol.*, 1959, 13 (10), 553.—An investigation on the preparation of pectin from raw papaya by aluminium chloride precipitation has shown that concentration of 0.5 per cent aluminium chloride in the cold at a pH of 3.8 to 4.0 gives the maximum yield of pectin. Optimum conditions for extraction and purification have been worked out. Precipitation at 70°C lowers the yield of pectin, though the quality of pectin is not much affected.

Jelly grade of pectin prepared from peel of raw papaya (18-20 per cent peel in the fruit) is lower than that prepared from peeled fruit. However, jelly grade of pectin prepared from whole fruit is only slightly lower than that from peeled fruit. Peeling of the fruit is therefore not considered necessary.

Yield of pectin prepared from second and third extracts is maximum. Jelly grade of pectin goes on increasing up to three extrac-

tions, after which it starts decreasing.

Storage of extract without added SO₂ for 4 days at 2-5°C or with SO₂ for four days at room temperature (20-25°C) does not seem to affect the jelly grade of the pectin. Methoxyl content of the pectins prepared from extracts stored up to 15 days with the addition of SO₂ at room temperature or without SO₂ at 2-5°C seem to remain unaffected.

Merits of AlCl₃ precipitation method as compared to the alcohol precipitation method are described.

Most of the soluble solids of papaya mince are leached out by two cold water extractions of 5 minutes each. Loss of pectin in leached water is practically negligible.

Thermal stability of allinase and enzymatic regeneration of flavour in odourless garlic powder, by Pruthi, J. S., Singh, L. J. and Lal, G., *Curr. Sci.*, 1959, 28 (10), 403.—The strong smell of garlic is due to the component, alliin, which is formed as a result of the cleavage of allin by the enzyme, allinase. Earlier workers have reported the properties of this enzyme which is sensitive to heat and is inactivated on steam bath in 30 minutes. The minimum time required for the inactivation of allinase in boiling water has, however, not been reported. In the present investigation, the authors have studied the thermal stability of allinase by blanching some lots of fresh garlic cloves in boiling water for 2.5, 5, 7.5, 10, 12.5, 15 and 20 minutes respectively. The lots were then immediately analysed for their anti-bacterial activity (A.B.A.) None of the blanched samples showed any A.B.A., indicating that allinase was inactivated even at 2.5 minutes' blanching. Odourless garlic powder was prepared by blanching fresh garlic for 5 minutes and then dehydrating it. The A.B.A. and flavour in the resulting powder was completely destroyed, although the colour was more white than that of the control sample. It

has been shown that the flavour can be fully regenerated by treating the odourless garlic powder with crude enzyme (allinase) solution, thus establishing that presence of allinase is essential for the conversion of allin to allacin responsible for the odour.

K.L.R.

Insecticidal effects of activated charcoal and clays, by Majumdar, S. K., Narasimhan, K. S. and Subrahmanyam, V., *Nature*, 1959, 184, 1165.—Several reports are available on the insecticidal properties of inert dusts. It was found that activated charcoal and decolourizing clays exhibited quicker effects on insects than unactivated dusts. The insecticidal properties of different activated charcoals and kaolinic clays passing through a 300-mesh have been tested against *T. Castaneum* adults and compared with the performance of unactivated samples. Mortality counts of insects at the end of different exposure periods and gas-absorbing, decolourizing qualities of the dust samples were determined. Activated charcoal and clay samples

showed, in general, high degrees of insecticidal activity. Activation improved the gas-absorbing and decolourizing qualities in the samples thus indicating the possible correlation between the insecticidal potency and the decolourizing or gas-absorbing capacity or both. Activated charcoals were found to be better insecticides than the activated clays or silic gel. Gas absorbing carbon of the type used in a gas-mask canister showed maximum effect resulting in 100 per cent mortality of the test insects within 4 hours exposure, while the unactivated charcoals gave 30 per cent or less mortality even after 24 hours exposure. It was also found that activated charcoal samples exhibited comparatively high levels of insecticidal potency even at 95 per cent R.H. and 30° C against *T. Castaneum* adults than other test materials. The results definitely show that activation treatment enhances the insecticidal potency of charcoal and clay samples.

K.L.R.

Application of thiobarbituric acid method to the estimation of

vanillin in vanilla essence, by Kapur, N. S., Bains, G. S. and Bhatia, D. S., *J. sci. industr. Res.*, 1959, 18 C (11), 275.—The authors have reported earlier a method for the colorimetric determination of vanillin using thiobarbituric acid (T.B.A.) reagent in which the interference by sugars in the reaction was indicated. In the present investigation, the interference by alcohol and glycerine in T.B.A. reaction and the application of T.B.A. method for the estimation of vanillin in commercial vanilla essence have been studied. The results show that alcohol up to a level of 0.4 per cent (or 40 per cent in the original essence) and glycerine up to 3 per cent in the reaction medium do not interfere with vanillin estimation. The T.B.A. method was employed for the estimation of vanillin in four samples of vanilla essence by following three different procedures. The results obtained have been compared with the values by the A.O.A.C. method. It is found that the T.B.A. and the A.O.A.C. methods give identical results.

K.L.R.

PART II (Indian)

ANALYTICAL

Paper chromatographic analysis of acids (horizontal migration method): Part VI—Separation and identification of amino acid mixtures, by Mohan Rao, V. K., *J. sci. industr. Res.*, 1960, 19 B (2), 62.—The paper chromatographic behaviour of amino acids in the presence of halogen acids and salts has been studied. The R_f values of amino acids are influenced by the nature and concentration of the salt present in the solvent rather than in the solution to be chromatographed. The presence of salt prevents the streaking of arginine and lysine halogen and salts and lowers the R_f values of amino acids at higher concentrations.

Paper chromatographic detection of nucleic acids with basic dyes, by Singh, C., *J. sci.*

industr. Res., 1960, 19 C (3), 78.—Basic dyes such as toluidine blue and azure C have been developed as sensitive staining reagents on chromatograms for the anionic polymers, R.N.A. and D.N.A. R.N.A. shows only a 'positive' metachromatic reaction, whereas D.N.A. exhibits both 'positive' and 'negative' metachromasia while reacting with the cationic dyes on paper. This is presumably due to two different components in commercial samples of D.N.A.

It has not been possible to separate R.N.A. and D.N.A. on paper chromatograms under the experimental conditions employed, but they both have been shown to be inhomogeneous products.

Estimation of saturated fatty acids of a fat by bromination followed by urea-adduction, by

Mehta, T. N., Murthy, M. S. and Meshramkar, P. M., *Indian J. appl. Chem.*, 1959, 22 (5-6), 218.—Several methods are available for estimating the saturated fatty acid content of fats but they have some limitation or other. The authors have developed a new method wherein bromination followed by urea adduction has been adopted. Bromination of the mixed fatty acids under specific conditions helps in converting the unsaturated acids into their bromo derivatives, the saturated acids being unaffected. The saturated acids are then separated as urea adducts by adding urea to the brominated mixture when the bromo-derivations of unsaturated acids do not combine with urea. The urea adducts are then decomposed with warm acidulated water and the fatty acids extracted with

ether. Saturated fatty acid content of cottonseed, peanut, physicnut, castor and *Chaulmoogra* oils has been determined by the new method and the results are comparable to those obtained by the lead salt-alcohol and oxidation methods. The method is quick, simple and reliable.

K.L.R.

BIOCHEMISTRY AND NUTRITION

Biosynthesis of ascorbic acid in germinating green gram (*Phaseolus aureus*) and in rice moth larvae (*Corcyra cephalonica* St.) by Thangamani, A. and Sarma, P. S., *J. sci. industr. Res.*, 1960 **19C** (2), 40.—The influence of the B-vitamins, thiamine and pantothenic acid, on the biosynthesis of ascorbic acid in germinating green gram and in rice moth larvae has been studied, with special reference to the role of these vitamins in the conversion of the precursor, D-glucuronolactone, to ascorbic acid, using the anti-vitamins, oxythiamine and omega-methyl pantothenic acid. The effect of the gamma-isomer of hexachloro-cyclohexane on the conversion of D-glucuronolactone to ascorbic acid has been studied, in rice moth larvae. It is found that all the three anti-vitamins inhibit the normal synthesis of ascorbic acid but only oxythiamine inhibits the conversion of D-glucuronolactone to ascorbic acid.

Pipecolic acid in common Indian pulses, by Inamdar, A. N., *et al.*, *J. sci. industr. Res.*, 1960, **19C**(2), 43.—Paper chromatographic examination of trichloroacetic acid and water extracts of the flours of 16 common Indian pulses for pipecolic acid has shown that the acid is present in the following 8 pulses: red double bean (*Vicia faba* Moench); white double bean (*V. faba*); field bean (brown; *Dolichos lablab*); *rajmah* (*Phaseolus vulgaris* L.); *tur* (red gram; *Cajanus indicus* spreng.); *kulith* (horse gram; *D. biflorus* L.) *udid* (*phaseolus mungo*); and *masur* (*lentil*; *Lencses ulenia* Moench); red double bean and *rajmah* have been found to con-

tain 2.72 and 3.31 per cent respectively of the acid.

Nutritive value of a protein digest made from oil cakes, by Chanan Singh and Krishna Murthi, C. R., *J. sci. industr. Res.*, 1960, **19C** (4), 87.—The nutritive value of a protein hydrolysate made from oil cakes has been assessed by the rat growth method and by using the digest to replace 'casamino acids' in the medium used for synthesis of amylase by pigeon pancreas. The cake hydrolysate has been found to sustain the growth of albino rats with the same degree of efficiency as casein. The cake hydrolysate also stimulates the synthesis of amylase by pigeon pancreas under aerobic conditions indicating that the amino acids present in the hydrolysate are available for protein synthesis.

Effect of rice polishing concentrate on liver lipids, by Chakrabarti, C. H., Saxena, K. L., and Nath, M. C., *Indian J. med. Res.*, 1960, 48 (2), 231.—Although rice polishing is a rich source of vitamins B₂ complex, it is not used in human dietary on account of its high cellulose content. The AA have prepared from 100 g. rice polishings 100 c.c. of the concentrate which was a good source of choline (122 mg. per cent) besides containing other vitamins. Choline is known to prevent development of fatty livers. In the present investigation, the effect of rice polishing concentrate on liver lipids has been studied. Fifty albino rats were divided into five groups and the different groups were fed on the following diets respectively: choline-free basal diet, 0.04 g. per cent choline containing basal diet, 0.128 per cent choline containing basal diet, 0.04 g. per cent choline containing basal diet plus 15 c.c. of rice polishing concentrate per 100 g. diet and 0.04 g. per cent choline containing basal diet plus 30 c.c. of the concentrate per 100 g. diet. The composition of the basal diet is given. The livers of the five groups of rats were periodically analysed for total lipids, phospholipids, free cholesterol,

cholesterol ester and glycerides. The results show that rice polishing concentrate added to 0.04 g. per cent choline containing basal diet at a level of 30 c.c. per 100 g. diet prevents the formation of fatty liver in rats while lower amounts of the concentrate (15 c.c. per 100 g. diet) are partially successful in this respect.

K.L.R.

Nutritive value of vegetable proteins Part III. Biosynthesis of vitamins B₁₂ and its utilization in rats on vegetable protein diets, by Ramachandran, M., Phansalkar, S. V. and Patwardhan, V. N., *Indian J. med. Res.*, 1960, 48 (2), 243.—The influence of the composition of the diet on vitamin B₁₂ activity of intestinal contents, faeces and tissues of experimental animals has been a subject of controversy. The authors have studied here the influence of vegetable protein diets consisting of 6 parts of cereal protein (4 different cereals), 3 parts of pulse protein (red gram) and one part of amaranth leaf protein with all vitamins and minerals excepting vitamin B₁₂ on the biosynthesis and utilization of vitamin B₁₂ in rats. Skim milk and whole egg protein at 10 per cent level were used as controls. Rats were kept on the experimental diets for 8 weeks. Fecal vitamin B₁₂ was estimated at the end of 4 and 8 weeks, while vitamin B₁₂ in liver and serum were determined only after 8 weeks by the microbiological method using *Lactobacillus leichmannii* as the test organism. The results show that vitamin B₁₂ like activity in the faeces of rats maintained on the vegetable protein diets was appreciable exceeding in many cases the initial values. The liver store of vitamin B₁₂ of the animals was significantly higher than at the start thus indicating the possibility of utilization of the biosynthesised vitamin B₁₂. The serum vitamin B₁₂ levels show a similar trend and lend support to the above view. The significance of the results obtained has been discussed.

K.L.R.

Effect of different buffers on the hydrolytic property of papain against casein, by Bahadur, K. and Atraya, B. D., *Indian J. appl. Chem.*, 1959, 22 (5-6), 221.—The effect of different buffers, *viz.*, (i) boric acid-succinic acid-sodium sulphate-borax, (ii) Na_2HPO_4 -citric acid, (iii) succinic acid-borax, (iv) acetic acid-sodium acetate, (v) boric acid-borax, (vi) KH_2PO_4 -borax and (vii) $\text{KH}_2\text{PO}_4\text{Na}_2\text{HPO}_4$, on hydrolytic property of papain against casein as substrate has been studied at different pH's and for different periods. Neutral or faintly alkaline solutions favour the hydrolysis of casein by papain. Most of the hydrolysis takes place during the first 48 hours, after which the amino acid content often remains the same.

Chemical studies on mycobacillin, by Majumdar, S. K., *Indian J. appl. Chem.*, 1959, 22 (5-6), 228.—Studies on the amino-acid composition of mycobacillin show that the molecule contains seven different amino-acid, *viz.*, aspartic acid, glutamic acid, tyrosine, serine, alanine, leucine and proline in the molar ratio of 5, 2, 2, 1, 1, 1 and 1 respectively. As a preliminary to the studies on amino-acid sequence of mycobacillin, HCl (conc.) has been selected as the suitable agent for effecting partial hydrolysis of the compound as it yields a large number of smaller peptides.

Relation of maturity to the composition of seeds of gram (*Cicer arietinum*), by Naik, M.S. and Narayana, N., *Indian J. appl. Chem.*, 1959, 22 (5-6), 239.—Immature green seeds of gram of about 30-50 days' maturity are widely consumed by the people and very little information is available on the chemical composition of the unripe seeds. The authors have therefore made a detailed study on the relation of maturity of the composition of the seeds. Pods were removed at three stages at 15 days intervals after pod formation and also at harvest stage when the pods were dry. The seeds of the four different stages of maturity were analysed for moisture, ether

extract, crude fibre, starch, sugars, ash, total nitrogen and nitrogenous constituents, minerals (Ca & P), vitamins (carotene, ascorbic acid, thiamine and riboflavin), phytin and lecithin. The results have been given on moisture-free basis and discussed in the light of the variation in the maturity of the pods. It is found that the immature seeds are richer in sugars, simple low-molecular nitrogen compounds, carotene, ascorbic acid and riboflavin as compared to the seeds at the harvest stage. The unripe seed also contains very little of phytin.

K.L.R.

Effect of amino acids and vitamin B_{12} on the nutritive value of pulse protein, by Singh, D. K., Gupta, Y. P. and Das, N. B., *Ann. Biochem. exptl. Med.*, 1960, 20 (1), 1.—The influence of amino-acids like methionine, tryptophan, threonine and lysine and of vitamin B_{12} on the protein efficiency ratio, biological value, digestibility and protein value of *arhar* and *urad* with growing rats has been reported. Methionine supplementation significantly improved the protein efficiency ratio as well as the biological value of both the pulses while lysine did so with *arhar* only. Tryptophan and threonine significantly increased the biological value of *arhar* but not that of *urad*. Digestibility and protein value of *arhar* and *urad* were not affected by such supplementation. Availability of amino-acids in *arhar* was found to be low and was increased by their supplementation. Vitamin B_{12} supplementation at 20 μg . per 100 g. diet caused an improvement in the growth-promoting value (FER) as well the biological value of *arhar* fed at 12 per cent but not at 17 per cent protein level.

Effects of partial replacement of rice or wheat by tapioca or sweet potato flour on the nutritive value of poor vegetarian diets: Influence of season in growth studies, by Majumdar, B. N., Sharma, D. C. and Kehar, N. D., *Ann. Biochem. exptl. Med.*,

1960, 20 (1), 7.—A study has been made on rats to determine the effects of replacing rice or wheat with tapioca or sweet potato flour during different seasons of the year. It is concluded that (1) seasons of the year appear to have considerable influence on the growth rate of rats. In winter the average growth in all comparable groups was much higher than in summer; (2) modification of a rice diet with tapioca flour to the extent of 25 per cent improved the nutritive value of the diet as shown by the increased gain in weight both in summer and winter; (3) when a wheat diet was thus supplemented its feeding value depended on the season; in summer the effect was, if anything, disadvantageous, whereas in winter growth was slightly better; (4) sweet potato flour in place of tapioca leads to an impairment in the nutritive value of the basal diet in summer or winter; (5) figures for increase in weight have been statistically examined and the significance discussed.

Studies on the utilization of vitamin A. Part IV. Influence of the level of protein on the storage and utilization of vitamin A, by Esh, G. C., Bhattacharya, S. and Som, J. M., *Ann. Biochem. exptl. Med.*, 1960, 20 (2), 15.—The influence of the level of protein (6 per cent, 12 per cent and 18 per cent) in the diet on the storage and utilization of vitamin A at levels of 50 I.U. and 710 I.U. per day during both maintenance and protein repletion periods has been studied in adult rats.

The results tend to indicate that during maintenance at the end of 2 and 4 weeks highest vitamin A content has been observed in liver at 12 per cent protein intake and at low supply of vitamin A. With massive doses of vitamin A, similar observation was made after two weeks but at the end of 4 weeks more vitamin A was stored by the animals receiving diet containing 18 per cent casein.

The protein-deficient animals were observed to store in the liver

during repletion period a lower quantity of vitamin A with higher quantity of protein in the diet at both low and massive doses of vitamin A feeding. The highest protein utilization was, however, indicated at 12 per cent protein in the diet. A slightly greater weight gain was observed when massive doses of vitamin A were fed at all levels of protein intake.

On the whole the results indicated that the level of protein in the diet had considerable effect on the utilization of vitamin A. Their possible inter-relationship has been discussed.

FISH

Component fatty acids of Indian shark and skate liver oils, by Pathak, S. P. and Trivedi, B. N., *Indian J. appl. Chem.*, 1959, 22 (5-6), 192.—Two samples of liver oil of an Indian species of shark and skate have been studied. Shark liver oil contains 41.1 per cent saturated acids (palmitic 29.6 per cent, stearic 5.4 per cent, myristic 5.9 per cent and minor proportions of arachidic and behenic acids) and 58.9 per cent unsaturated acids (C_{16} 12.5 per cent, C_{18} 20.1 per cent, C_{20} and above 23.8 per cent and minor proportion of C_{14} monoethenoids). Skate liver oil contains 41.7 per cent saturated acids (palmitic 26.9 per cent, stearic 12.5

per cent and myristic 2.3 per cent) and 58.3 per cent unsaturated acids (C_{16} 11.8 per cent, C_{18} 37.2 per cent, C_{20} and above 7.8 per cent and minor proportions of C_{14} acids).

FRUIT AND VEGETABLE PRODUCTS

Nutritive value of some fruits of Kashmir valley, by Andrabi, S. M. H. and Magar, N. G., *Indian J. appl. Chem.*, 1959, 22 (5-6), 231. The nutritive value of fruits such as apples (*Pyrus mallus*), pears (*Pyrus communis*), quince (*Cynodina vulgaris*) and 'trelas' (*Mallus sylvestrus*) has been studied. Results of the proximate analysis show that acidity in sour apples is three times more than that of sweet apple. The reducing sugar constitutes 80 per cent of the total sugar. Crude protein is higher in trelas. Calcium content is low except in the case of 'trelas', Copper, cobalt and molybdenum also have been detected while nickel is completely absent in all the fruits.

While ascorbic acid content is higher in quince, vitamin B_1 content is maximum in sour apple. Riboflavin and niacin contents are higher in the 'trelas'. Carotene is present in traces in all the fruits except in the case of 'trelas'.

Folic acid has been observed to be very high in pear as compared

to the other fruits. Vitamin B_{12} -like activity is higher in pear, followed by quince and is minimum in the apples. Sugars, organic acids and amino-acids have been detected using paper chromatographic techniques.

OILS AND FATS

Fractionation of peanut oil fatty acids by extractive crystallisation with urea, by Mehta, T. N. and Meshramkar, P. M., *Indian J. appl. Chem.*, 1959, 21 (5-6), 211.—Mode of distribution of the mixed 'solid', and 'liquid' fatty acids of peanut (*Arachis hypogaea*) oil has been studied by liquid-solid countercurrent distribution with urea. A similar distribution of the saturated acids (obtained on bromination of the mixed fatty acids, followed by urea adduction) has also been carried out. Higher saturated fatty acids, free from unsaturation, have been obtained in the first two experiments, while a complete separation of the saturated acids, from the unsaturated ones, could be accomplished in the bromination experiment. The typical percentage fatty acid composition, calculated from these data, is myristic 0.67, palmitic 4.86, stearic 8.16, arachidic 2.80, behenic 3.97, lignoceric 1.53, oleic 51.69 and linoleic 26.32.

PART III (Foreign)

ANALYTICAL

Rapid combustion and determination of residues of chlorinated pesticides using a modified Schoniger method, by Lisk, D. J., *J. agric. Fd. Chem.*, 1960, 8 (2), 119.—A method is described for the rapid combustion and determination of residues of chlorinated pesticides. Organic solvent extracts of plant samples are evaporated in a cone of cellulose acetate, which is burned in an oxygen-filled (Schoniger) flask and the hydrogen chloride gas is absorbed in dilute sodium hydroxide. The platinum holder has been specially designed

and a balloon attached to the flask to permit complete combustion of the cone and its contents safely. The spectrophotometric determination of chloride is based on its displacement of thiocyanate in the presence of ferric ion. The time required for combustion and determination of chloride is about 20 minutes per sample. The recovery of D.D.T., Thiodan, and lindane from alfalfa by the method is described.

Determination of small amounts of arsenic in potatoes. Extraction and reduction of molybdoarsenic acid, by Lisk,

D. J., *J. agric. Fd. Chem.*, 1960, 8 (2), 121.—A method is presented for the determination of small amounts of arsenic in potatoes. Potato tissue is ashed with magnesium nitrate and the ash dissolved in acid. Acid-molybdate is added, followed by extraction with a 1-butanol-chloroform mixture to remove interfering phosphorus as molybdophosphoric acid. The aqueous solution is extracted with 1-butanol to remove arsenic as molybdoarsenic acid. A simple procedure is then used for adjusting acidity and reducing to the heteropoly blue with stannous chloride in

ethyl alcohol. The effect of varying the concentration of acid and reducing agent on the blue colour is shown. Silicon causes some interference. Silicon interference can be reduced by use of a 1-butanol-ethyl acetate mixture for extraction of molybdoarsenic acid. The method used to determine possible traces of arsenic in potatoes resulting from the application of sodium arsenite to kill potato vines and weeds, yields an average recovery of 94.1 per cent.

Complexometric titration of calcium and magnesium in the presence of phosphate in milk and blood plasma, by Kamal, T. H., *J. agric. Fd. Chem.*, 1960, 8 (2), 156.—A quick and sensitive method for determining calcium and magnesium in biological materials, with particular reference to milk and blood plasma, is presented. The interference of phosphate ions in this complexometric titration was eliminated by adding the disodium salt of (ethylenedinitrilo) tetraacetic acid to the neutral system and back-titrating the excess with calcium and magnesium standard solutions. Milk and blood plasma samples were used directly without removing the phosphate ions or milk proteins.

ANTIOXIDANTS

On the antioxidant activities of the tocopherols, by Lea, C. H., *J. Sci. Fd. Agric.*, 1960, 11 (4), 212.—The antioxidant activities of the tocopherols have been compared at 60° and at 37° in distilled methyl esters of cottonseed, linseed and cod liver oil fatty acids containing small additions of oxidised ester as 'starter'.

In the linoleate (cottonseed) system the α - and β -compounds were the most and the α -, β - and γ -compounds the least effective in extending the induction period. In the poly-unsaturated (linseed and cod liver oil) systems the α -was still good, but the β -was at the bottom of the series and the β - and γ -compounds near the top.

Factors, in addition to the presence of polyunsaturated fatty esters in the substrate, which tended to favour a relatively high activity of the α -compound were (a) comparison of activities at a low peroxide value, still within the induction period and (b) a not too high temperature of oxidation. Under suitable conditions— α tocopherol could be shown to exert the highest and β -the lowest *in vitro* antioxidant activity, in agreement with their known *in vivo* vitamin-E potencies.

The antioxidant activities of the tocopherols are considered in relation to their structure.

COFFEE

Analysis of the volatile constituents of coffee, by Rhoades, J. W., *J. agric. Fd. Chem.*, 1960, 8 (2), 136.—Studies on the roasting of seven varieties of coffee show that generally the concentration of volatiles in the bean increases with increased roasting. Hydrogen sulfide, methyl formate and acetyl propionyl reach a maximum concentration within the normal roasting temperatures. The concentration of dimethyl sulfide remains essentially constant during the roasting process. Analysis of green beans shows differences which may be useful in typing or grading green coffee. In roasted coffee, the ratio of diacetyl to acetyl propionyl may be indicative of the degree of roast. Analysis of brewed coffee shows the concentration of volatiles to be in the range of 1 to 2000 p.p.b.

DAIRY

Free and bound lactose in milk, by Dutra, R. C., Jennings, W. G., and Tarassuk, N. P., *J. agric. Fd. Chem.*, 1960, 8 (2), 143.—By using both isotope dilution methods and a conventional protein precipitation technique, it was demonstrated that in unheated milk 0.54 per cent lactose is associated with milk protein (s). The association is apparently weak, as all lactose is removed from unheated milk by dialysis for 72 hours. The

results suggest an equilibrium, free lactose, bound lactose, favouring a free-bound ratio of about 8 to 1. Binding of lactose by heated proteins, which is apparently a carbonyl amino reaction, was investigated at 80° and 100° C. The activation energy of the reaction, probably the first step in the browning reaction, is of the order of 11×10^3 calories per mole.

FISH

Sodium ion, potassium ion, and weight changes in fish held in refrigerated sea water and other solutions, by MacLeor, R. A., Jonas, R. E. E., and McBride, J. R., *J. agric. Fd. Chem.*, 1960, 8 (2), 132.—When sockeye salmon, halibut, herring, lemon sole, and brill were stored in refrigerated sea water for a week, analyses of the flesh revealed a rise in sodium ion and a drop in potassium ion over the natural levels. Weight increases in the fish ranging from 2.4 per cent for salmon to 17.5 per cent for a group of lemon sole were recorded after storage. The outer layer of the flesh of sockeye salmon showed a slow rise in sodium ion and a drop in potassium ion content over the first 48 hours of immersion in chilled sea water, after which time much more rapid changes in the flesh levels of these ions occurred. When solutions were prepared containing sodium and potassium ions at concentrations approximating those calculated for the total tissue water of the fish, the sodium and potassium ions level of the flesh of fish immersed in them remained close to their natural values. It was found that the weight changes of the fish could be prevented by adding 2 per cent of polyvinylpyrrolidone to the immersing solutions.

FLAVOUR

Flash exchange gas chromatography for the analysis of potential flavour components of peas, by Rallas, J. W., *J. agric. Fd. Chem.*, 1960, 8 (2), 141.—The technique of flash exchange gas

chromatography was applied to the determination of aldehydes, ketones, and acids in the steam distillate of peas. The compounds identified were acetaldehyde, acetone, propionaldehyde, n-butyraldehyde, n-valeraldehyde, biacetyl, formic acid, acetic acid and isovaleric acid. All these components occurred at a concentration of less than 3 p.p.m. on a fresh-weight basis. A mixture of these compounds at the concentration levels found did not reproduce the characteristic odor of pea steam distillate.

FRUIT AND VEGETABLE PRODUCTS

Chemical inactivation of enzymes in vegetables before dehydration, by Makower, R. U., *Food Technol.*, 1960, 14 (3), 160.—Enzyme inactivation by chemical treatment at room temperature has been explored as a possible means of obtaining dehydrated vegetables of high quality. The initial experiments encouraged further investigations. The present paper describes methods developed and used for chemical enzyme inactivation and its testing. Nearly complete inactivation of tested enzymes was observed in shredded cabbage and pieces of apple, carrot and celery which had been infiltrated under vacuum with a mixture of acid, alcohol, and a surfactant. None of these three components alone significantly inactivated the enzymes tested (catalase, peroxidase, acetyl esterase, phosphatase, and polyphenol oxidase) under the experimental conditions used. Enzyme inactivation increased with decreasing pH of the infiltration solution. Strong mineral acids with a pH of 1.5 or lower in the infiltration mixture were best enzyme inactivators. Anionic, cationic, and non-ionic surface-active compounds were tested as additives to the acid-ethanol mixture used for enzyme inactivation. A number of the surfactants synergistically enhanced the enzyme-inactivating action of the acid-ethanol mixture. The inactivation of enzymes increas-

ed with higher concentrations of the surface-active compound. In general, the anionic surface-active compounds were most effective synergistic enzyme inhibitors in the acid-ethanol mixture, while the cationic compounds were least effective. It is difficult to assess from the available data the relation between chemical structure of the surfactant and its effectiveness in the synergistic inhibition of plant enzymes. Of the enzymes tested, peroxidase appeared to be the most difficult to inactivate.

Chemical and colour changes in canned tomato ketchup, by Luh, B. S., *Food Technol.*, 1960, 14 (3), 173.—One of the programmes of the Department of Food Science and Technology at the University of California, Davis, concerns factors influencing storage stability of processed foods. Interest shown by canners in the stability of canned ketchup gave impetus to a study on the effect of storage temperature and time on chemical and colour changes in canned tomato ketchup. Several objective tests for evaluating storage changes are presented. Canned tomato ketchup was made under controlled conditions and stored at temperatures varying from 20° C (68° F) to 55° C (131° F) for 14 months. The product was tested for chemical and colour changes during storage. Results indicate that chemical changes occurred rapidly in ketchups stored at temperatures higher than 20° C (68° F). Serum colour darkened and titratable acidity increased. High storage temperatures also contributed to decreases in amino nitrogen and degradation of colour. The serum colour test was found to be useful for detecting poor storage conditions in ketchup. To maintain good quality, storage at a temperature of 20° C (68° F) or lower is desirable. The importance of storage temperature on stability and chemical composition of ketchup is discussed.

Influence of ripeness level on organic acids in canned tomato juice, by Fidel Villarreal, Luh, B. S.,

and Leonard, S. J., *Food Technol.*, 1960, 14 (3), 176.—In the present investigation, the silicic acid column chromatographic method was used to determine the effect of ripeness level on organic acids in canned tomato juice. Samples were freeze dried prior to column chromatography. The Agtron E was used to measure the colour of the fresh Pearson tomatoes. The readings, based on the ratio of green/red reflectance, corresponded with the visual colour grading and the lycopene content of the tomatoes. An increase in pH and a decrease in titratable acidity was found to occur during ripening. The importance of these factors in processing canned tomato products is discussed. Citric acid was found to be a major organic acid in tomatoes, and was about 73-80 per cent of the total organic acids. It decreased rapidly during ripening. Pyrrolidonecarboxylic acid was also an important organic acid in canned tomato juice. Acetic and formic acids were found only in very minute amounts. The importance of these acids to tomato juice quality is discussed.

Diffusion of sulphite during vegetable dehydration, by Duckworth, R. B., and Marian Tobansnick, *J. Sci. Fd. Agric.*, 1960, 11 (4), 226.—Prepared samples of potato, carrot and cabbage were scalded in solutions containing sulphite labelled with ³⁵S. The distribution and movement of sulphite during subsequent dehydration and storage were studied by autoradiographic methods. After dehydration of potato and carrot strips, the sulphite is distributed throughout the strip with a slight concentration at the centre. The development of brown centres in such material is therefore not due to inadequate penetration of sulphite, but probably to accumulation of sugars and amino-acids in this region. In cabbage, the sulphite is readily taken up on the veins of the leaf.

OILS AND FATS

Composition of cherry seed and cherry seed oil (*prunus*

cerasus), by Weckel, K. G., and Lee, H. D., *Food Technol.*, 1960, 14 (3), 151.—The processing of cherries results in the disposal of very large quantities of cherry seeds. In Wisconsin and Michigan, the total cherry production averages 120 million pounds annually. The seeds are not used to provide income to the canners or growers. Kernels from cherry pits have been reported to contain an oil resembling that of almond. The amount of oil in the kernels ranges from about 30 to 38 per cent of the dry kernel weight. The weight of the kernel represents 28 per cent of the total cherry pit weight. The weight of the most cherry pit is about twice the weight of the dried cherry pit. From these data, it has been estimated that the amount of cherry oil potentially available in Wisconsin and Michigan is 100,000 gallons. Cherry kernels have a fairly high protein and starch content which may have potential in animal and food mixtures. The composition of cherry kernel oil resembles that of almond oil and is quite similar to that of corn oil, peanut oil and sesame seed oil. Elaeostearic acid was shown to be present in cherry kernel oil. The presence of elaeostearic acid may be the cause of accelerated development of oxidative rancidity observed in the oil.

PACKAGING

The collapsible polyethylene tube as a food package, by Kemp, J. D. *et al.*, *Food Technol.*, 1960, 14 (3), 131.—Many types of military field rations contain spreads such as jam, jelly and peanut butter. Individual rations require a light weight package containing about two ounces of such a spread. Standard commercial packages are usually cans or glass jars which contain quantities sufficient for several meals. The smallest sanitary can commercially available in Canada holds four ounces of jam and the only individual portion package—the small-formed plastic cup used by restaurants and air-

lines—is too fragile for military use. To satisfy the need for a suitable package—one that is light in weight, will protect the food satisfactorily for two years at 70° F, will withstand a moderate degree of rough usage, is capable of being reclosed, and will not present a serious damage hazard to other packages with which it might be assembled—the use of collapsible polyethylene tubes was considered. The tubes proved to have considerable strength. A filled and properly sealed tube laid on its side would support one hundred and fifty pounds weight without rupturing; therefore the tubes were not regarded as being a serious breakage risk in field rations. A series of storage experiments was conducted in the cold (0°F), at a normal room temperature (70°F) and at an elevated temperature (100°F). The products were raspberry jam, grape jelly, honey, peanut butter and creamery butter. Lined (*i.e.*, coated with polyvinylidene chloride resin) and unlined collapsible polyethylene tubes were the containers. Lined tubes were found to be more suitable than unlined tubes because of a lesser tendency to produce off-flavours and because of their impermeability to oils. This impermeability indicated their potential suitability as packages for oily foods such as butter and peanut butter, but oxygen transmission characteristics of the tubes should be investigated more fully. During comparative tests at 100°F the storage life of jam, jelly and honey in lined tubes was generally comparable to that in bottles or cans for periods up to three months; thereafter, the quality of foods in bottles and cans was slightly superior.

PESTICIDES

Ether-extractable urinary phosphates in man and rats derived from malathion and similar compounds, by Mattson, A. M., and Sedlak, A. M., *J. agric. Fd. Chem.*, 1960, 8 (2), 107.—The urinary excretion of malathion

derived materials was studied the develop a chemical method which could be used as a measure of exposure. Following exposure to malathion, ether-extractable phosphatic compounds appear in the urine of man and rats. Quantitative determination was accomplished by a colorimetric method for phosphates. The amounts of these materials were proportional to dosage. Preliminary studies with other similar compounds were made. This method is useful in detecting and evaluating the degree of exposure to malathion. It is far more sensitive than measurement of cholin-esterase inhibition.

A sensitive procedure for urinary p-nitrophenol determination as a measure of exposure to parathion, by Elliott, J. W., *et al.*, *J. agric. Fd. Chem.*, 1960, 8 (2), 111.—A sensitive procedure has been developed for the determination of p-nitrophenol in urine. The major variation from earlier published procedures involves extraction with acetonitrile to remove interfering impurities. The present method allows determination of as little as 10 of p-nitrophenol and permits the use of urine samples as large as 100 ml.

Retention of acrylonitrile and carbon tetrachloride by shelled walnuts fumigated with acrylon by Ben Berck, *J. agric. Fd. Chem.*, 1960, 8 (2), 128.—Imported shelled walnuts, in 55-pound batches, were successfully fumigated in polyethylene bags to control insect infestation by injecting each bag with 3 ml. of Acrylon. Desorption rates of acrylonitrile and carbon tetrachloride during a 38-day storage period showed that their residual amounts were effected by fumigant dosage, duration of exposure, and aeration by fan. Fumigation under reduced pressure, followed by storage for 30 days, resulted in acrylonitrile and carbon tetrachloride residues which were lower than those obtained by fumigation at atmospheric pressure. Acrylonitrile was determined polarographically and carbon tetrachloride

spectrophotometrically with satisfactory specificity and sensitivity.

PLANT GROWTH REGULATOR

Synthesis and preliminary evaluation of amino acid derivatives of 2-(2, 4, 5-Trichlorophenoxy) propionic acid, by Krewson, C. F., *et al.*, *J. agric. Fd. Chem.*, 1960, 8 (2), 104.—A series of D-, L-, and DL- amino acids involving 2- (2, 4, 5, trichlorophenoxy) propionic acid has been prepared and evaluated. A wide variety of notable differences in behaviour pattern in this new series is sharp contrast to generalities reported for the halogen-substituted phenoxyacetic acid series. The derivatives of L- and DL- amino acids reported here proved generally to be active plant-growth regulators with high selectivity during the test period on the assay plants used; an exception was the derivative of L-tryptophan, which was completely inactive. The D-amino acid derivatives were almost completely lacking in growth-regulating properties with the exceptions of the D-alanine, and D-tryptophan derivatives are easily prepared and purified and those with sharp melting points may be useful in characterization of amino acids.

GENERAL

The production of amylose and amylopectin in corn endos-

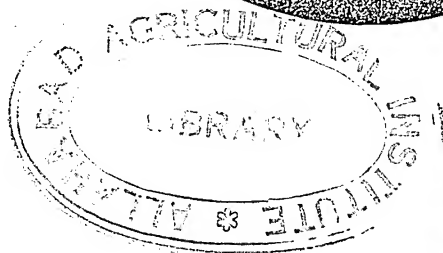
perms and in potato tubers, by Erlander, S. R., *Cereal Chem.*, 1960, 37 (1), 81.—Experimental evidence indicates that amylose and amylopectin are produced simultaneously. Consequently any proposed mechanism for the synthesis of starch based on the assumption that the branching enzyme is inactivated at some time during the day, in order to enable the synthesis of amylose, would appear to be invalid. Amylose (3.1 per cent) was produced in very immature waxy corn endosperm by covering the ears with cellophane bags. One can postulate that the production of starch by plants occurs via glycogen. That is, plant glycogen is attacked by a theoretical debranching enzyme which (a) removes the outer or available branches of the glycogen to form amylopectin and then (b) connects these removed branches end-to-end to form amylose. In normal waxy endosperm the absence of amylose can be explained by assuming the presence of an inhibitor of the proposed debranching enzyme. The production of amylose in very immature waxy corn endosperm indicates that the activity of this inhibitor may be diminished by retarding the growth of certain factors in the very immature waxy corn endosperm. The average chain length of amylose appears to increase with an increase in the average chain length of the corres-

ponding amylopectin. These results can be explained by assuming that the degree of polymerization of the unit chains removed by the proposed debranching enzyme remains constant. Consequently, the degree of polymerization of an amylose appears to be a function of the chain length of its parent glycogen.

Behaviour of starch during food preparation. II. Effects of different sugars on the viscosity and gel strength of starch pastes, by Bean, M. L. and Osman, E. M., *Food Res.*, 1959, 24 (6), 665.—The effect of ten different sugars and syrups on the hot-paste viscosity curves and gel strength of 5 per cent corn starch paste has been studied. With all the sugars and syrups used, there was a slight increase in the maximum hot-paste viscosity attained during gelatinization with concentrations of sugar up to 10 or 20 per cent, but a decrease occurred with higher concentrations. There were small but consistent differences among the effects of the different sugars. At higher concentrations the disaccharides were more effective in inhibiting gelatinization than were equal concentrations by weight of monosaccharides. Concentrations of 20 per cent or higher of all sugars and syrups used caused decided decreases in gel strength of the starch pastes.

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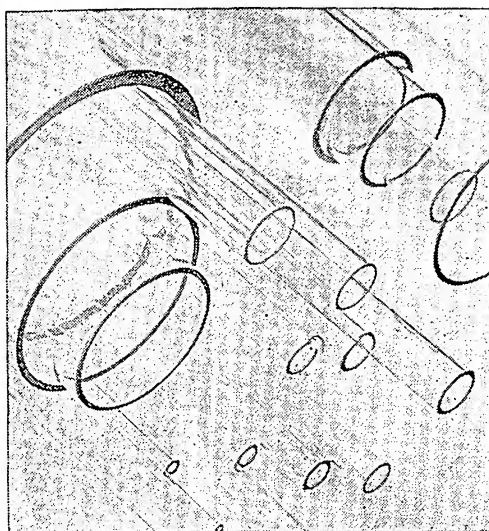
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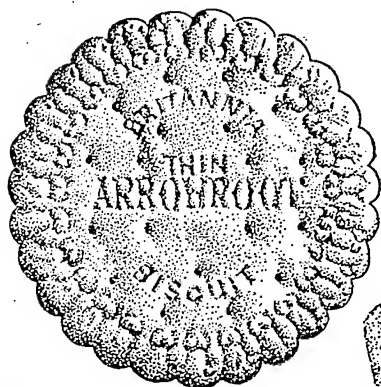
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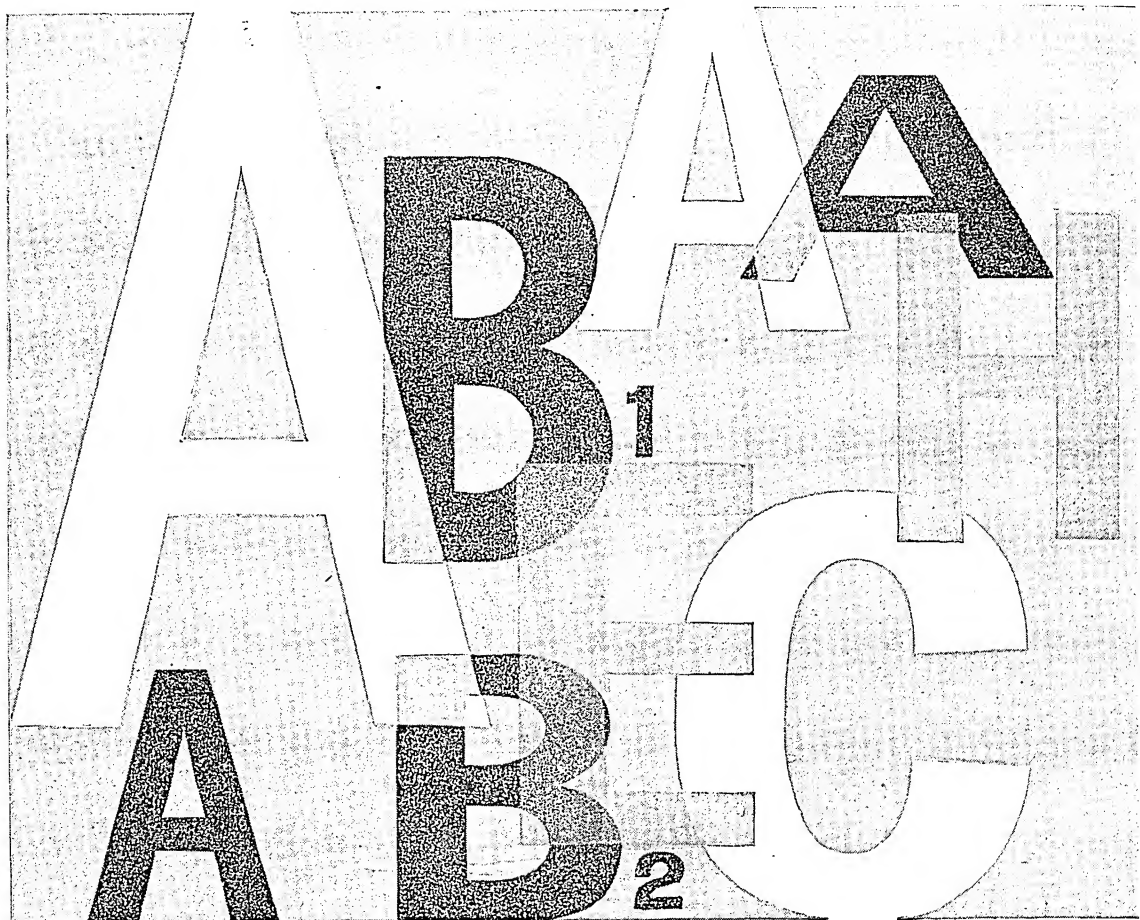
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- 1. SOME ASPECTS OF FOOD TECHNOLOGY IN INDIA** (*published in August 1959*), pp. 160. (Editors—H. A. B. Parpia, R. C. Bhutiani, K. L. Radhakrishnan, A. N. Sankaran and B. V. Subbarayappa)

This is a publication specially brought out on the occasion of the F.A.O. Regional Seminar on Food Technology for Asia and the Far East held in Mysore from August 1-8, 1959. It is a collection of 26 review articles, which cover exhaustively the research work done in India on some of the important aspects of Food Science and Technology, particularly those dealing with rice and rice substitutes; fruit and vegetable products; dehydration of foods; storage, packaging and transport of perishables; infant, invalid and protein-rich foods; beverages, spices and condiments; etc. The book represents under one cover the important lines of work and progress made in India in the field of Food Technology.

Price: (Bound) Rs. 10.00 (*postage extra*); £1.5.0; \$ 4.00.

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This publication, contains the views and suggestions of prominent scientists, leading industrialists and food technologists, and Government officials on the nature of technical aid needed by different food industries in the country. Up-to-date technical and statistical data are provided and an appendix embodying the conclusions of the Symposium as well as a comprehensive index are given.

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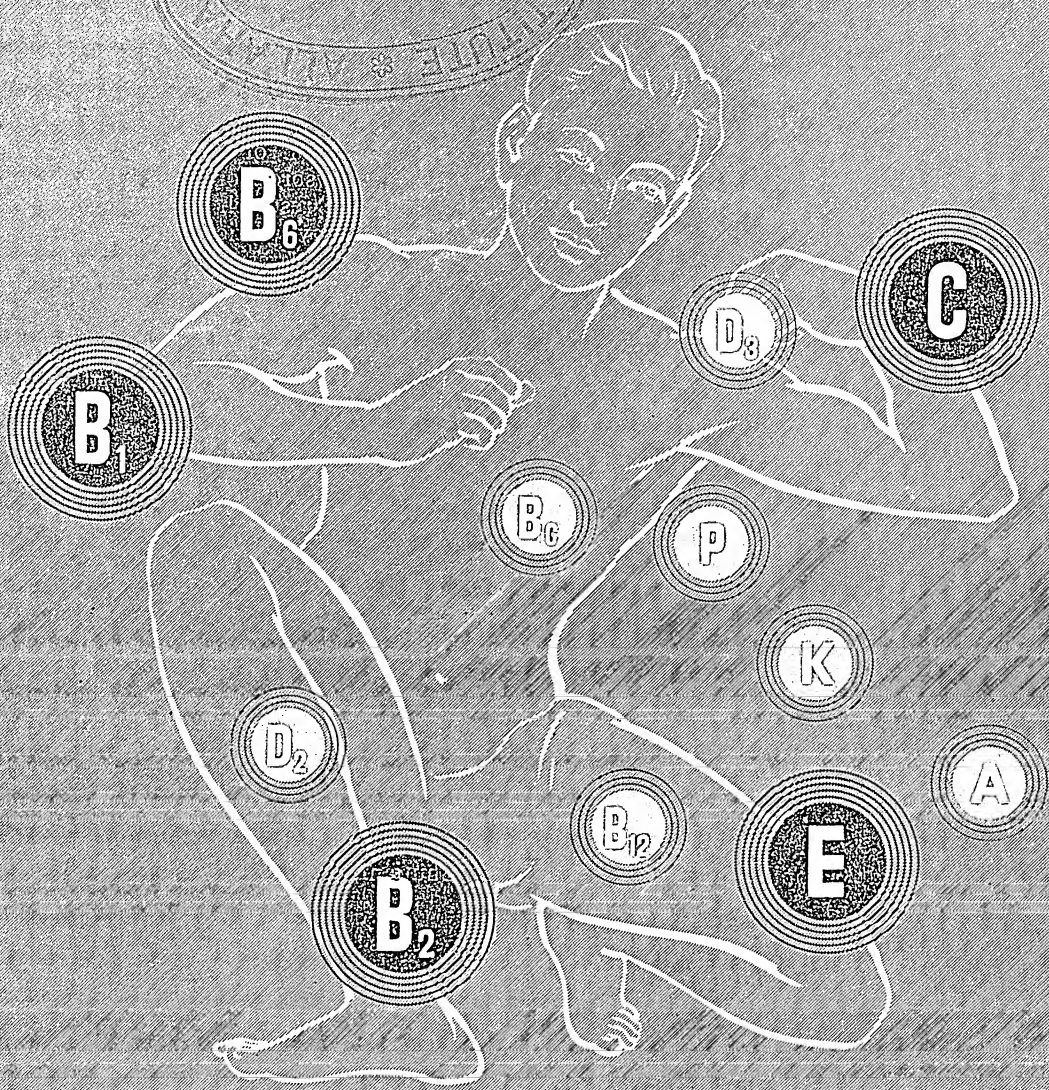
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CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE, MYSORE

SYMPOSIUM ON PROTEINS

At its meeting during January 1960, the *Chemical Research Committee of the Council of Scientific and Industrial Research* recommended that a Symposium on Proteins may be held under its auspices at the Central Food Technological Research Institute, Mysore. The Governing Body of the C.S.I.R. approved of the proposal and the Symposium was held, jointly with the *Society of Biological Chemists, India*, from 14th to 16th August, 1960.

It was realized by the conveners that the subject of proteins represents a vast field of study and that there are already several active schools of research in the field, in India. The scope was naturally made comprehensive so as to include the following major aspects:

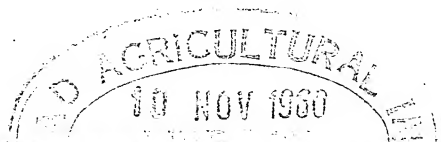
1. Chemistry 2. Biochemistry 3. Technology 4. Nutrition.

There was enthusiastic response from all over the country and there were no less than 85 contributions from about 150 authors most of whom were present and took active part in the discussions.

Before reviewing the proceedings which covered the best part of three days, it may perhaps be pertinent to touch briefly on the development of protein research in India which dates back to slightly over three decades. Among the earlier workers it may be pertinent to refer to: McKay who was probably the first to draw attention to the deficiency of proteins in Indian dietary; Norris and his associates who started programmes of work on the isolation and systematic examination of proteins in different food grains and pulses; Sreenivasaya *et al.* on protein metabolism in conditions of health and disease in plants, as also on different milk proteins and non-proteins; Subrahmanyam, Desikachar, Sreenivasan and others on the bulk preparation of vegetable proteins and their practical application; Guha and his

associates on leaf proteins, metallo-proteins and other active proteins; and Mitra and associates on the biological value of different proteins and protein intake through diet surveys. During the past 10-15 years several new schools of advanced research have sprung up in different parts of the country such as those of Sreenivasan and associates on inter-relation between proteins, enzymes and vitamins; Sarma *et al.* on iodo-proteins and synthesis of other active proteins; Mukerji, Shrivastava, Krishnamurthi and others on inter-relation between proteins and hormones; Patwardhan, Gopalan, Venkatachalam and their associates on the utilization of different types of proteins and their bearing on the treatment of protein malnutrition. Other groups of workers such as those headed by Achar, R. N. Choudhury, K. C. Choudhury, Radhakrishna Rao have also made practical contributions in this field. Kamala Sohoni and her associates have contributed to the study of trypsin inhibitors, while Cama *et al.* have studied the nature and physico-chemical behaviour of different proteins. To the credit of (*late*) Professor Giri must be mentioned the adoption of electrophoretic separation for the characterization of proteins. Among the younger group who have returned to India with good credit of work in the field of protein biochemistry in the States and who are pursuing researches in the country on proteins must be mentioned Drs Bachawat, Bhargava and Bhattacharya. Dr Esh and his team have utilized to the maximum extent the advantages of that facile tool of paper chromatography for determining free amino acid make-up in a number of edible plant materials.

It was not a fortuitous coincidence that the Symposium on this very important subject was held in Mysore. Since its inception, about a decade ago, the Central Food Technological Research Institute has been devoting a large



amount of attention to the production, processing and utilization of proteins, chiefly of vegetable origin. The Institute has today the largest concentration of workers drawn from different disciplines such as biochemistry, nutrition, health, microbiology, processing technology and engineering. Without making any invidious distinction, special mention may be made of group leaders such as Swaminathan and Rajagopalan; Narayana Rao, Bhagavan and Doraiswamy; Srinivasan, Kuppuswamy and Rao; Bhatia and Subramanian; Kalbag and Chandrasekhara; and Johar and Lulla. The more recent work of the Institute on the production and utilization of protein isolates has opened up a vast vista of possibilities in regard to the treatment of protein malnutrition especially in the case of weaned children and those of the pre-school age.

The Symposium was inaugurated on 14th August by Professor M. S. Thacker, Director-General of Scientific and Industrial Research at a function presided over by Shri P. A. Narielwala, Director of Tata Industries. Shri B. D. Jatti, Chief Minister of Mysore could not be present, but his address was read by Shri Vasudeva Rao, Divisional Commissioner of Mysore. Dr V. Subrahmanyam, Director, Central Food Technological Research Institute welcomed the delegates and Dr Ramakrishnan read the speech of Dr Khanolkar, President of the Society of Biological Chemists. Dr B. C. Guha, Chairman of the Chemical Research Committee, addressed the gathering and Dr A. Sreenivasan proposed the vote of thanks.

In the course of his address, Professor Thacker referred to the growing volume of appreciation of Indian work in various fields. He referred in particular to the work on protein-rich foods and their practical application. Mr Narielwala made appreciative reference to work on protein isolates and their utilization. He also referred to the need for closer contact between science and industry. Shri B. D. Jatti referred to the importance of human values in scientific research. Both Dr Guha and Dr Subrahmanyam referred to the recent advances in the field in India and the extension of the findings both in India and abroad. Dr Khanolkar referred to some of the important contributions made by Indian workers.

The papers that were presented and discussed dealt with different facets of protein research like chemistry, biochemistry including biosynthesis, metabolism and inter-relationship, immunological and microbiological aspects, technology and nutrition.

The papers on protein biosynthesis adduced evidence to show that vitamin B₁₂ has no direct role in the process. Streptomycin at certain concentrations inhibits net protein synthesis in *E. coli* without affecting RNA and DNA synthesis. Interdependence between nucleic acid and protein synthesis was brought out by some contributions. In the group of papers discussed under inter-relationships, protein metabolism in scurvy and influence of dietary protein levels on the vitamin C status of the rat, effect of protein quality on the various body constituents including blood-sugar levels and glucose tolerance, were discussed.

Among the papers on technology, special reference may be made to those on grass proteins, edible quality groundnut flour and its utilization for the production of protein-rich food compositions for different age groups, integrated process for the production of protein along with starch and other fractions from oilseeds, and preparation of fish flour. The discussion elicited a number of interesting points and it was noted that some of the products were already under production or in the process of being developed on a large scale.

Papers relating to nutritional aspects quite naturally focused attention on the extensive prevalence in the country of protein malnutrition and the possible methods of combating it. Several of the contributions dealt with the use of protein-rich materials of vegetable origin, both individually and in combination for the treatment of the condition. The results generally showed that edible quality groundnut flour, Bengal gram, etc. can be used with fair success though the time taken for complete cure was longer than that with skim milk powder. The vegetable preparations were generally more effective in arresting diarrhoea, but slower in bringing about albumin regeneration. There was one interesting paper on the use of protein isolates, by themselves and in combination with

some essential amino acids or skim milk powder. There was evidence to show that isolated proteins were therapeutically more effective than protein-rich meals. Preliminary results obtained at Hyderabad also supported this view.

There was a substantial mass of evidence to show that countries like India, where there is extensive protein malnutrition, can make use of their abundant sources of vegetable proteins, as also fish proteins and fish flour with positive benefit. The production of protein isolates as by-products of oil manufacture will yield still more concentrated products that can be easily

administered and assimilated. The last line which is now being intensively developed in India is already attracting a considerable amount of attention and will lead to extensive developments in different parts of the world.

Some of the subjects discussed at the Symposium have found their echo at the International Congress for Nutrition and the Protein Malnutrition Conference at Washington where Indian workers are taking a leading part in several of the discussions.

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RESEARCH SECTION

CHANGES IN THE PHYSICO-CHEMICAL COMPOSITION OF MANGOES DURING RIPENING AFTER PICKING

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In the course of an investigation on the preparation of mango cereal flakes^{1,2} it was of interest to find out the correct stage of maturity after picking of some of the South Indian commercial varieties of the fruit. Earlier work on the changes in the carotenoid pigments³ and

ascorbic acid⁴ content of different varieties, as also overall changes taking place during ripening of Pakistani mangoes⁵ has been reported. Composition of two South Indian varieties, *Kalapad* and *Rumani* mangoes has been studied⁶. Changes during cold storage of different varieties of mangoes have also been reported by other workers⁸⁻¹⁰. Cheema and Dani⁷ have defined four stages of maturity in *Alphanso* mangoes. In the present report changes in the physical and chemical composition of four South Indian varieties, *viz.*, *Badami*, *Raspuri*, *Totapuri* and *Neelam* mangoes have been briefly described.

Material and Methods

In commercial practice, fully developed mangoes are usually picked from trees and the fruits are stored under varying conditions for ripening. In this study, however, hard and green mangoes of the four varieties mentioned above were stored under straw in a closed room and were carefully sorted out in the course of ripening into four different stages as given below:

Stage 1: Fruits green and hard, pulp practically white.

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Stage 2: Fruits with greenish yellow colour just appearing and slightly soft to touch. Pulp yellowish. In the case of *Totapuri* mangoes fruits were greenish to greenish yellow.

Stage 3: Fruits with yellow colour appearing and yielding to thumb pressure. Pulp of yellow colour.

Stage 4: Fruits with almost yellow colour and soft to touch. Pulp of deep yellow colour.

The fruits were peeled by hand with stainless steel knives. Pulp was easily obtained from the 3rd and 4th stage fruits by passing through a pulping machine, while it was not possible in the case of 1st and 2nd stage fruits due to their hard texture. They were, therefore, cut into small pieces, blended in a waring blender for 5 minutes and the pulp was obtained by passing through a 30 mesh sieve. Samples were taken immediately for analysis.

The firmness of the flesh was determined at four random places of the fruit after removing thin slices of the skin with a knife and using a special hand operated 'Pressure tester' or 'Penetrometer' which recorded the pressure in pounds necessary for the plunger to penetrate into the flesh. Average from 8 fruits, *i.e.*, a total number of 32 readings, was taken as a value for firmness. Soluble solids were determined by hand refractometer; moisture, water insoluble solids and acidity by A.O.A.C. methods; pH by a Cambridge pH meter; β -carotene by the official method of the Association of Vitamin Chemists¹¹ and sugars by colorimetric method of Ting¹². Colour and flavour of the pulps were evaluated organoleptically.

Results and Discussion

The physical and chemical constituents in various stages of maturity of the four varieties of mangoes under investigation are given in Table I. It will be seen that total solids of the pulps at all stages of maturity remained more or less constant. As the maturity advanced the soluble solids, pH, β -carotene, and total sugars increased, while acidity, water insoluble solids and firmness of the fruits decreased rapidly. Glucose and fruc-

tose increased gradually in *Badami*, *Raspuri* and *Neelam* varieties, whereas a sudden decrease was observed in both the sugars from 3rd to 4th stage in *Totapuri* variety. Sucrose content increased regularly in all cases except for a small decrease in *Badami*, *Neelam* (3rd to 4th stage) and *Totapuri* (2nd to 3rd stage) varieties. Total sugars increased gradually in all varieties except for a slight decline in *Badami* mangoes at fully ripened stage. Amongst sugars, sucrose was more in fully ripened *Badami*, *Raspuri* and *Totapuri* mangoes, while fructose was more in *Neelam* mangoes. Wahab and Khan⁵ reported that the reducing sugars were more or less constant, while total sugars increased gradually with progressive ripening in *Langra* and *Ghulab Khas* mangoes. Contrary to the above report, the results in the present investigation indicated that both reducing and total sugars increased with ripening.

Fully ripe fruits of the different varieties had penetrometer readings varying from 1.15 to 3.90. The range of penetrometer readings of each individual variety should be taken into consideration while judging the maturity of that particular variety.

Flakes prepared from the above pulps indicated that fully ripe mangoes only gave highly acceptable product with regard to colour, taste and flavour. Pulps from under-ripe fruits yielded poor quality flakes lacking in both colour and flavour.

Summary

Four varieties of mangoes, *viz.*, *Badami*, *Raspuri*, *Totapuri* and *Neelam* were analysed at four different stages of maturity to find out the physico-chemical changes taking place after picking. Total solids of the pulps at all stages of maturity remained constant. Soluble solids, pH, β -carotene and sugars increased while acidity and water insoluble solids decreased rapidly with progressive ripening. Good quality flakes could be obtained from fully ripened fruits only.

Acknowledgement

The authors feel highly grateful to Dr V. Subrahmanyam, Director, and Dr Girdhari Lal, Assistant Director, of the Institute, for their keen interest in this investigation.

TABLE I. Changes in physico-chemical characteristics of mangoes during ripening after picking

Variety	Fruits		Fruit pulps											
	Stage of matur- ity	Pressure test in lbs.	Brix at 20°C	Water insoluble solids %	Total solids %	pH	Acidity (anhy. citric acid) %	β -Carotene mcg. %	Glucose %	Fructose %	Sucrose %	Total sugars%	Colour	Flavour
<i>Badami</i>	1	25.85	8.30	9.66	17.88	2.63	3.41	345	0.22	1.06	1.81	3.09	Pale white	No flavour
„	2	12.66	13.30	5.98	18.90	2.85	2.08	1413	0.70	1.79	6.50	8.99	Dull yellow	Mild
„	3	6.30	18.31	0.88	19.11	3.68	0.81	4883	1.91	2.95	11.25	16.11	Yellow	Marked flavour
„	4	3.90	19.32	0.22	19.37	4.04	0.38	6607	2.07	4.04	9.69	15.80	Orange yellow	Strong flavour
<i>Raspuri</i>	1	15.75	7.29	11.44	18.09	2.64	3.50	1231	0.25	0.75	1.33	2.33	Pale white	No flavour
„	2	7.37	15.31	6.31	19.98	2.94	2.12	1498	0.84	1.45	7.33	9.62	Dull yellow	Very mild
„	3	2.80	16.31	2.11	18.42	3.22	1.17	3094	2.13	3.11	8.13	13.37	Yellow	Mild
„	4	1.15	18.31	0.72	18.97	3.82	0.57	4952	2.06	3.44	10.52	16.02	Deep yellow	Marked
<i>Totapuri</i>	1	...	...	...	...	...	...	...	...	...	...	...	...	...
„	2	20.06	12.80	5.51	18.53	3.07	1.71	513	0.74	2.52	4.04	7.30	Pale white	No flavour
„	3	14.25	14.31	4.11	18.70	3.11	1.69	566	1.85	4.69	2.14	8.68	Dull yellow	Very Mild
„	4	2.41	17.31	1.40	18.75	4.24	0.32	1976	0.55	3.23	9.52	13.30	Yellow	Mild
<i>Neelam</i>	1	30.00	12.80	5.82	17.81	3.06	1.50	130	1.79	2.71	1.40	5.90	Pale white	No flavour
„	2	18.44	14.31	5.02	18.30	3.10	1.28	490	1.91	2.66	3.44	8.41	Dull yellow	Very mild
„	3	10.08	16.31	3.65	18.84	3.46	0.88	844	2.46	2.68	4.95	10.09	Yellow	Mild
„	4	3.47	18.31	1.30	18.90	4.74	0.16	2381	3.07	7.75	4.00	14.82	Slight orange yellow	Marked

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KEEPING QUALITY OF BISCUITS FORTIFIED WITH PROTEINS AND VITAMINS

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Subrahmanyam and his co-workers have standardised a formula for the manufacture of 'Nutro' biscuits fortified with protein, calcium and vitamins¹. Narayanan *et al.*, have studied the stability of B-vitamins in these biscuits during baking under different conditions². This paper deals with the keeping quality of the product during storage period of seven months.

Experimental

Freshly manufactured 'Nutro' biscuits were obtained from a commercial firm packed in paper and tin containers. The approximate percentage chemical composition was: moisture, 1.8; protein, 15.4; fat, 17.7; total ash, 2.3; calcium, 202 mg.; reducing sugar, 0.2; sucrose 24.2; thiamine, 1.07 mg.; riboflavin, 2.53 mg.; nicotinic acid, 34.3 mg. and vitamin A, 1520 I.U. They were stored at R.T. (25-30°C) and 37°C and analysed for pH, moisture, free fatty acids (F.F.A.), carbonyl values, and vitamins initially and at regular intervals for a period of 7 months.

Proximate analysis was carried out according to the methods described in earlier communications^{3,4}. Vitamin A was determined colorimetrically by AOAC method⁴ based on Carr-Price reaction. Carbonyl value was estimated by the method of Berry and McKerrigan⁵. The results are shown in Table I.

Discussion

The pH of the biscuits in all cases slowly decreased from 6.36 to 6.24 during the storage period. The moisture content of the biscuits in paper cartons progressively increased from 3.0 to 5.7 per cent stored at both temperatures. There was no appreciable increase (1.8 to 2.2 per cent) in moisture content of biscuits packed in air-tight tins. There was no peroxide development in any of the samples. The F.F.A. increased from 26.5 to 29.7 mg. per 100 g. in case of paper cartons and to 28.7 mg/100 g. in case of tin containers stored at both temperatures. Carbonyl values for unsaturated aldehydes continuously increased from 11.0 to 31.4 millimoles

TABLE I. Effect of storage on the keeping quality of 'Nutro' biscuits

Period of storage (months)	Moisture (%)				Carbonyl value (millimoles/kg. fat)								Thiamine (μg./g.)				Vitamin A (I.U./g.)			
	Room temp.		37°C		Unsaturated				Saturated				Room temp.		37°C		Room temp.		37°C	
	Paper	Tin	Paper	Tin	Paper	Tin	Paper	Tin	Paper	Tin	Paper	Tin	Paper	Tin	Paper	Tin	Paper	Tin	Paper	Tin
0	3.0	1.8	3.0	1.8	11.0	11.0	11.0	11.0	13.0	13.0	13.0	13.0	10.7	10.7	10.7	10.7	15.2	15.2	15.2	15.2
1	3.4	2.1	3.0	1.9	11.2	11.3	11.2	11.2	13.2	13.4	13.2	13.2	10.7	10.7	10.7	10.7	15.2	15.2	15.2	15.2
2	4.1	2.0	3.4	1.9	...	...	...	...	...	...	...	...	10.6	10.7	10.7	10.7	15.2	15.2	14.0	14.4
3	4.7	2.0	4.4	2.0	19.5	19.1	19.6	19.2	26.5	...	26.5	27.6	10.4	10.5	10.5	10.4	12.8	13.2	11.2	11.6
4	5.0	2.2	5.0	2.2	21.9	19.9	22.7	21.4	27.0	23.5	24.6	22.3	10.4	10.5	10.1	10.4	12.0	12.9	10.0	10.8
5	5.4	2.3	5.5	2.4	...	...	...	...	...	...	...	...	10.3	10.3	10.1	10.1	10.8	12.0	9.0	9.4
6	5.7	2.2	5.5	2.2	27.0	25.6	26.8	25.6	29.2	27.0	28.6	27.0	10.2	10.2	9.9	9.9	10.0	11.0	8.8	9.0
7	5.7	2.2	5.6	2.2	30.4	28.5	31.4	29.0	30.7	28.3	31.9	28.9	9.9	9.9	9.4	9.4	10.0	10.8	8.0	8.4

NOTE: Changes in pH, FFA, riboflavin and nicotinic acid are not recorded as there was no appreciable change during the period of storage.

per kg. fat in paper cartons and to 29.0 in tin containers at 37°C. Similarly, the carbonyl values for the saturated aldehydes increased from 13.0 to 31.9 millimoles/kg. fat in paper cartons and 28.9 in tin containers. There was no appreciable difference in the keeping quality of biscuits stored in the range of 25-37°C for a period of 7 months. Moreover, biscuits packed both in paper and tin containers were acceptable organoleptically during the storage period of 7 months. However, the air-tight tin containers behaved much better than the paper cartons.

There was no loss in the riboflavin and nicotinic acid contents of the fortified 'Nutro' biscuits during the storage period. There was a slight decrease (8 per cent) in thiamine content of biscuits stored at 37°C. During storage, the vitamin A content of the biscuits progressively decreased, loss in paper cartons at room temperature being 34.2 per cent and that at 37°C 47.3 per cent. Vitamin A was found to be a little more stable in tin containers; loss being 28.9 at room temperature and 44.7 per cent at 37°C.

Summary

'Nutro' biscuits stored in the range of 25-37°C were acceptable after a period of 7 months. Tin containers behaved better than paper packets. There was no appreciable loss in thiamine, riboflavin and nicotinic acid contents of fortified biscuits. In the case of vitamin A, the loss was about 40 per cent.

Acknowledgement

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PACKAGING OF MOISTURE SENSITIVE CEREAL PRODUCTS—PAPADS

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Introduction

As an article of savoury food *papads* have an important place in our dietary. This is generally made on home-scale. Recently, considerable quantities are made on cottage industry scale. The amount of production of this commodity is increasing and there seems to be a good potential export market mostly to the middle east countries, U.K. and the U.S.A.

The product is usually made from a blend of cereal and pulse flours with salt and spices. A small amount of baking soda is also added while making the dough. The recipe varies from region to region. The dough is rolled into thin discs of varying diameters, and sun dried. At present units of 100 each are wrapped in tissue or kraft paper and sold as such. In such packages,

papads are exposed to atmospheric changes and are liable to get mouldy in a short time.

It was therefore of interest to study the physico chemical characteristics of the product in order to design a suitable package which would give a shelf-life of four to six months under different climatic conditions that exist during transit and storage. This study was undertaken at the instance of a firm in U.P. which is keenly interested in exporting this product to the U.S.A.

Materials and Methods

Freshly made *papads* were obtained from the firm and all the studies reported were carried out with this sample. Humidity, moisture relationship of the product were carried out at room temperature by placing weighed quantities of

samples in chambers maintained at relative humidities ranging from 63 to 92 per cent. Saturated solutions of appropriate salts were used in each case to maintain constant humidity in chambers¹. These samples were periodically weighed till constant weights were obtained or till they showed signs of mould growth, whichever was earlier. Results of these studies are presented in Table I. The moisture pick up or loss was confirmed in each case by carrying out moisture determination in the equilibrated samples.

TABLE I. Humidity-moisture relationship of papads at 27°C

Sl. No.	Relative humidity %	Equilibrium moisture content	Period of attaining equilibrium in moisture content (days)
1	63	14.0	50†
2	75	20.5*	24
3	80	25.5*	12
4	85	32.7*	7
5	92	47.0*	5

* Mould growth was observed even before the product reached equilibrium moisture content.

† The experiment was continued up to 150 days and no mould growth was noticed.

The original product even under normal conditions develops mould in a very short time, thereby indicating that the moisture level of the product is very congenial for the development of moulds. Such a product is not amenable to packaging. Therefore it is desirable to bring down the initial moisture content to such a level as to prevent mould development. Humidity-moisture relationship studies indicated that if the product has a moisture content below 18 per cent, the product would not be susceptible to mould growth. From the packaging point of view, it would be desirable to have the moisture content of the product as low as practicable. But products of this type when dried to very low levels of moisture are liable to become brittle, thereby rendering it difficult to pack. Studies were carried out to determine

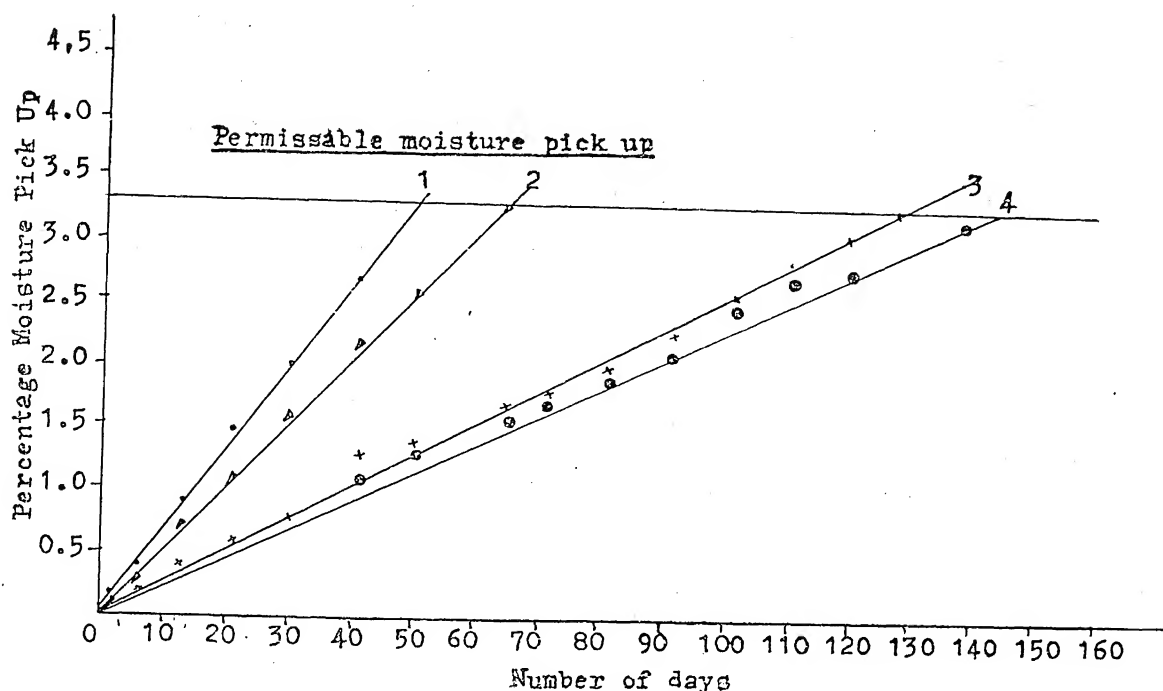
the optimum moisture level of the product from the point of pliability. Representative samples were conditioned to different levels of moisture and were judged for their pliability and brittleness. It was observed that a moisture content below 12 per cent would render it very brittle, while with about 14 per cent moisture, the product had the desired pliability. The moisture content of the original product was therefore brought down to 14.7 per cent and the packaging studies were carried out with this conditioned product.

TABLE II. Moisture content in relation to pliability and susceptibility to mould growth of papads

Sl. No.	Moisture content %	Pliability	Susceptibility to moulds
1	23	Very soft ...	Susceptible to mould growth
2	18	Soft ...	Border line
3	15	Pliable ...	Not congenial for mould growth
4	14	Pliable ...	"
5	12	Not pliable ...	"
6	9	Brittle ...	"

The product being moisture sensitive, requires protection against ingress of moisture. Though hermitically sealed tin container is the ideal package, it proves to be uneconomical. The other alternate packages would be those made from moisture-proof flexible packaging films. At present moisture-proof cellulose and polyethylene films of varying gauges are manufactured in India. In view of certain practical advantages of polyethylene over moisture proof cellulose film, the present studies were confined to packages made out of polyethylene film of gauge ranging from 150 to 500. Compatibility of the packaging material with the product was studied as described earlier by Murthy *et al*².

The packaging trials were designed to assess: (1) the shelf-life of the product in various gauges of the film and (2) the size of the unit pack in relation to the shelf-life of the product. Suitable bags in quadruplicates of sizes 8"×8" and 8"×9" for half and one pound respectively in various gauges were made and after heat sealing were



GRAPH I. Moisture pick up in relation to the shelf-life of papads in polyethylene packages stored at 100°F and 92% R.H.

(NOTE: Initial moisture content was 14.7%)

1. 150 gauge, one lb. unit. 2. 250 gauge, half lb. unit. 3. 250 gauge, one lb. unit. 4. 500 gauge, half lb. unit.

TABLE III. Percentage moisture pick up of papads packed in polyethylene and stored at 92% R.H. and 100°F.

Gauge of polyethylene package	Quantity of material	Storage period (in days)														
		2	6	13	21	30	41	50	65	71	81	91	101	110	120	138
1. 150 gauge	1 lb.	0.1	0.3	0.9	1.5	2.0	2.7	3.3*	...	...	...	...	...	...	...	...
2. 250 "	$\frac{1}{2}$ lb.	0.2	0.4	0.7	1.1	1.6	2.2	2.6	3.2*	...	...	...	...	...	...	...
3. 250 "	1 lb.	0.1	0.2	0.4	0.6	0.9	1.3	1.4	1.7	1.8	2.0	2.3	2.6	2.9	3.1*	...
4. 500 "	$\frac{1}{2}$ lb.	0.06	0.2	0.4	0.6	0.8	1.1	1.3	1.6	1.7	1.9	2.1	2.5	2.7	2.8	3.2*
5. Control with 23.5% moisture in glass bottles	...	(*)	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6. Control with 14.7% moisture in glass bottles	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

NOTE: (i) The initial moisture content of the product was 14.7%.

(ii) (*) Signs of mould growth.

(iii) Sample No. 6 remained in good condition throughout the period of storage.

subjected to accelerated storage tests at 100 F. and 92 per cent R.H. Under the same conditions samples of the original product with 23.5 per cent moisture and conditioned sample with 14.7 per cent moisture level were kept in separate air-

tight bottles. The packs were periodically weighed to assess the moisture pick up during storage and they were examined for signs of mould growth. The results of these studies are presented in Table III and also shown in Graph I.

When the packs showed a moisture pick up of above 3 per cent or developed signs of mould growth they were withdrawn from storage and were checked up for their moisture content. In order to check up whether the moisture picked up during storage had uniformly equilibrated throughout the bulk of the product, moisture determinations were carried out at various points, such as periphery, centre etc.

Results and Discussion

Compatibility studies showed that the packaging material does not impart any taint of its own to the product. The results in Table I indicate that the *papads* kept at 63 per cent R. H. at room temperature do not induce fungal spoilage even at the end of five months, while those kept at relative humidities of 92, 85, 80 and 75 per cent showed fungal damage at the end of 5, 7, 12 and 24 days respectively. Samples kept at 63 and 75 per cent R. H. were in equilibrium with a moisture content of 14.0 and 20.57 per cent respectively. It is known that when the relative humidity in the ambient atmosphere is above 70 per cent, products of this nature are susceptible to fungal spoilage³. The above studies indicate that a moisture content of about 18 per cent would be critical from the point of mould growth. The conditioned product as used in these studies having a moisture content of 14.7 per cent will have a permissible uptake of about 3.0 per cent which it could pick up during storage without developing mould growth.

From Table III, it may be seen that the control samples with a moisture content of 23.5 per cent developed mould growth in 3 days, whereas the sample with 14.7 per cent moisture content did not develop mould growth even at the end of 138 days. One pound samples packed in 150 gauge polyethylene, showed signs of mould growth at the end of 50 days, when the moisture pick up was about 3.3 per cent. The sample on analysis had a moisture content of 18.0 per cent thereby confirming the earlier observation that the critical moisture content of the product is about 18 per cent. Analysis of the sample at the centre, periphery and at various layers indicated that moisture content of the product was uniform at all points. One pound samples

packed in 250 gauge film developed mould growth at the end of 120 days, whereas half pound sample in the same gauge film became mouldy at the end of 65 days. Although the total surface area of the one pound package is about 15 per cent more than that of half pound package, the shelf-life of the one pound package is nearly double that of the half pound package. It may be of interest to note that though the difference in the quantity of water vapour ingress between the two packages is only about 15 per cent the product in the half pound package seems to have attained the critical moisture content much earlier than the product in the one pound package. The above observation demonstrates that the shelf-life of a product could be nearly doubled by packing twice the quantity of the product in the same gauge film with slight increase in size.

Half pound unit pack made of 500 gauge film showed signs of mould growth at the end of 138 days, whereas the half pound unit made of 250 gauge film became mouldy at the end of 65 days indicating that the shelf-life of a unit package could be increased two fold by doubling the gauge of the film used. It may be mentioned that the above correlation holds good only in the case of products, where moisture pick up is the determining criterion.

Paine⁴ has shown that it is possible to predict the approximate shelf-life of products by accelerated storage studies. The shelf-life studies reported in this paper were made under accelerated conditions, namely, 100°F and 92 per cent R.H. The results indicate that a one lb. unit pack in 250 gauge polyethylene film has a shelf-life of 120 days. On the basis of the correlation reported by Paine⁴ and taking into consideration the conditions in the sales area, the shelf-life of the above package will be much greater than 120 days. In actual practice, the package is usually enclosed in an attractively printed carton and overwrapped with moisture-proof cellulose film, which would further increase the shelf-life of the commodity.

Summary

1. Studies have been carried out to design a suitable package for *papads* which are moisture-sensitive in character.

2. It has been found that the product as at present marketed is not amenable to packaging. Since the *papads* have a critical moisture content of 18 per cent, it is considered desirable to condition the product to a moisture level of about 14 per cent to render it fit for packaging.

3. Results show that there is a correlation in the shelf-life of the product between the quantity of the material in the package and gauge of the film used. Similarly the shelf-life of the unit pack in a particular gauge film could be enhanced by increasing the gauge of the film.

4. In a 250 gauge polyethylene film package, under accelerated conditions of storage *viz.* 100°F and 92 per cent R. H. the *papads* have a shelf-life of 120 days. In a trade pack having a overwrap of moisture-proof cellulose film, the product will have a much longer shelf-life and

an attractive sales appeal which would meet the requirements of export trade.

Acknowledgement

The authors are deeply indebted to Dr V. Subrahmanyam, Director, Central Food Technological Research Institute, Mysore, for his kind encouragement and active interest in these studies. We are thankful to Messrs. Basrae and Co., Hapur for having kindly supplied materials for these studies.

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Universal Colorimeter Model J

For Colorimetry, Fluorimetry and Nephelometry

The instrument works on 2 photocells in balanced circuit which makes the readings very stable. The readings are consistent and easily reproducibly. A constant voltage transformer is built-into it to eliminate the effects of line voltage fluctuations (within plus/minus 30%). The instrument is highly sensitive because the transformer keeps the colour temperature of the lamp constant.

An important feature of the Lange Colorimeter is the builtin calibrating device by means of which the colorimeter can be calibrated before taking measurements thus making the readings independent of the age of the lamp or photocells.

This is the most versatile Colorimeter: it takes both test-tubes and rectangular cuvettes (from 0.1 to 100 ml). It can be used for fluorimetry and nephelometry, a third photocell being placed below the left hand photocell at right angles for measurement of scattered light. By means of the reflectance accessory the colour of solids and powders can be measured.

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Other Instruments: Flame photometers Polarographs, Illumination meters, Reflection and Gloss meters, Fluorescence and Turbidity meters.

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Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during July 1960 are given in this section.

S (IS) 19

Studies on the dry salting and sun-drying of mackerel (*Restreli-gier canagurta* Cuv.), by D. P. Sen (July 12, 1960).—The speaker first described the status of fish-curing industry in India. Of the total catch of about 12 lakh tons of fish in 1957, comprising of about 3-lakh tons of fresh water fish and about 8,90,000 tons of marine fish, more than 50 per cent is cured and sun-dried. Moreover, cured and sun-dried fish products secure for India a good amount of foreign exchange. Mackerel constitutes about 10 per cent of total marine catch and more than 60 per cent of mackerel catches are cured. Of the different curing processes that are practised in India, dry salting and drying in sun forms the most important method of curing in India.

A short review of the work carried out in India on the curing of fish was then given. From the results reported, it seems that the products sold on the market are unattractive without any standard, varying widely in their chemical qualities. They cannot also be stored for long. The main causes of deterioration have been attributed to attack by red-halophils and by molds. Some work attempting to fix up the ratio of salt to fish for curing has been done and it has been variously described ranging from 1:4 to 1:8. The present investigation was undertaken with a view to standardising and improving the existing method of dry-salting and sun-drying of mackerel to obtain a standard product with good shelf-life.

For the purpose of salting, commercial dry salt procured from Malpe Government Fish Curing Yard, Government of Mysore, was used. Fish was dressed in two

ways: (1) by removing the gills and gut which is referred to as 'gutted fish'; and (2) by splitting it open after removal of gills and gut which is called as 'split-open fish'. The speaker first described the experiment on the uptake of sodium chloride and loss of water during the course of salting. A ratio of 5:1 for fish: salt was fixed in this experiment as this quantity of salt was sufficient to saturate all the moisture in the fish body. On the basis of maximum loss of water, it was concluded that 24-26 hours of salting was sufficient for 'gutted fish' and 18 hours for 'split-open fish'. During the course of salting, there appeared to take place some loss of nitrogen from the fish flesh.

Results of experiments on drying in sun under different conditions, namely, in hanging position, on terrace floor, on coir mattress spread over terrace floor, were then presented. It was found that fish on coir mattress and terrace floor dried at a higher temperature than fish dried in hanging position. Furthermore, fastest drying rate was obtained on terrace floor. Fish, split open and with flesh to the sun, dried more quickly than fish with scale and skin to the sun. Rate of drying decreased rapidly on each day, but keeping the fish stacked overnight improved the rate of drying next day.

Describing the effect of different periods of salting and drying in sun on terrace floor and in hanging position on the texture of the cooked product, the speaker said that (a) lower the degree of salting and drying, better was the product and (b) drying in hanging position appeared to give a better product. Study on the content of total volatile bases during salting and

drying in sun indicated no significant change in TVB during the period of salting. On the first day of drying in sun, there was a rise of TVB value, but on the subsequent days of drying, there was no further significant changes in TVB values.

During the storage study of market samples of sun-dried salted mackerel with high moisture content (46.5 per cent), attack by molds and reddening was encountered in 6-7 weeks. When moisture content was low (20.83 per cent), the product became brown in about 4 weeks and fungal growth appeared after about 14 weeks. But, the products prepared in the laboratory with 40 per cent moisture level without any treatment, during a storage period of about 21 weeks, did not turn red as compared with the market sample having 46.5 per cent moisture which turned red in 6-7 weeks. Laboratory samples prepared without any treatment were also better than the market samples so far as onset of fungal growth, rate of change of total volatile bases, rate of browning and cooking quality, were concerned.

Describing the efficacy of chlortetracycline, a mixture of sodium acid phosphate and sodium benzoate, sodium propionate with and without chlortetracycline and sorbic acid in conjunction with C.T.C. the speaker stated that (a) although C.T.C. treatment could lower the total count of salted fish and prevent browning to a large extent, it had no effect against fungal attack; (b) treatment with sorbic acid in conjunction with C.T.C. had no effect in preventing mould attack and (c) treatment with 10 per cent sodium propionate was successful in preventing fungal attack. Experiments on the equilibrium moisture content of sun-dried salted

mackerel for different relative humidities showed that the equilibrium moisture content for 70 per cent R. H. at 78°F was 37.5 per cent. Concluding the speaker said that the present investigation would be helpful in preparing a standard commodity with a good shelf-life. Further work in the line will be continued.

Some of the important points raised during the discussion were: anticipated storage life for salted and sun-dried mackerel, correlating the results with the high humidity conditions prevailing in the coastal area, reconstitution quality of the final product, need for preventing fermentation during stacking of the fish, whether any insect infestation was observed, stability of C. T. C. used in the experiment, pH of the material, antagonism towards the use of C. T. C. and sorbic acid, etc.

Winding up the discussion, the President emphasized the need for doing such work under the conditions existing in the coastal areas, where mackerel was mostly caught. Some method should be thought of for curing and preserving fish wherein not much of solubles are leached out from the fish and not much of preservatives are absorbed by the fish. The problem of toughening in the final product needs to be properly investigated, with a view to preventing it and keep the flesh soft by some steeping treatment even after drying. Referring to the spoilage of dried fish, he said that the peroxide value was not a correct index of spoilage. It is necessary to thoroughly investigate into the mode of reactions that cause browning. Whether the red halophilic bacteria pick up some iron thus causing browning should be also ascertained. He concluded by saying that it should be our endeavour to see whether a fresh approach could be made and a new technique evolved to get a dried product with all its original qualities and with the salt concentration at the minimum level. This would also help in attracting foreign markets for our products.

S (IS) 20

The effect of replacing rice by jowar (*Sorghum vulgare*) at varying levels on the nutritive value of poor Indian diets, by P. P. Kurien (July 30, 1960).—*Jowar* is a grain of considerable importance in the dietary of millions of people in the different parts of India, and is considered as a nourishing food by the habitual *jowar* eaters. In view of the present shortage of rice in the country, the use of *jowar* and other millets as partial substitutes for rice needs to be studied. Hence, investigations were undertaken to find out the effect of partial or complete replacement of rice by *jowar* on the nutritive value of poor Indian diets.

The nutritive value of poor rice diets in which rice was replaced by *jowar* at 25 per cent, 50 per cent and 100 per cent levels was studied by the rat growth method. The results showed that there was only a slight increase in the growth rates of rats when the rice in the diet was partially or completely replaced by *jowar*. No significant difference was observed either in the haemoglobin content or the total serum protein content of the blood of rats fed on the experimental diets. No significant difference was observed in the fat content of livers of different groups of rats which fell within the normal range. The protein content of the livers of rats of fed on 100 per cent *jowar* diet was, however, slightly less than that of the livers of rats fed on other diets. The results of the experiment clearly indicate that *jowar* can be used as a partial substitute (25 per cent level) for rice without affecting adversely the overall nutritive value of the rice diet.

The effect of partial (25 or 50 per cent level) or complete replacement of rice in a poor rice diet by *jowar* on the metabolism of nitrogen, calcium and phosphorus was also studied in seven boys aged 10-11 years. The nitrogen intake on the different diets

ranged from 6.34 to 6.91g. corresponding to 39.6 to 43.2g. of protein per day. The apparent digestibility of the protein decreased as the level of *jowar* in the diet increased and this may be due to the increase in the fibre content of the diet as a result of the incorporation of *jowar*. All the subjects were in positive nitrogen balance on all the four diets. Maximum retention of nitrogen was observed in the case of children fed on the rice diet. The retention of nitrogen decreased as the level of *jowar* in the diet increased.

The mean daily intake of calcium slightly increased as the level of *jowar* in the diet was raised. The calcium intake was considerably lower than the recommended allowance to children of this age group. The mean daily retention decreased with the increase in the *jowar* content of the diet, which may be due to the higher phytate phosphorus content of *jowar* as compared with raw milled rice. All the subjects were in positive calcium balance on all the four experimental diets. The intake and retention of phosphorus steadily increased as the *jowar* content of the diet increased. All the subjects on the different diets were in positive phosphorus balance.

In view of the low digestibility of the proteins present in *jowar*, studies were also undertaken on the distribution of protein, calcium and phosphorus between the husk and endosperm of three different strains of *jowar*. The separation of the husk and endosperm was effected by soaking the whole grain for 48 hours in water containing 0.05 per cent metabisulphite, grinding and separating the husk on a 100 mesh sieve. The husk accounted for 10.3 per cent of the weight of the grain. The germ was separated from the husk by suspending it in water and adjusting the specific gravity when the germ comes to the top and is removed by a fine sieve. Analysis of the husk showed that it contained 18 per cent of the total protein,

20 per cent of the total calcium and 13 per cent of the total phosphorus of the whole grain. The results showed that the nitrogen present in the husk did not account fully for the low digestibility of *jowar* proteins.

The points raised during the discussion related to genesis of the whole problem, need for comparison after carrying out long-range experiments with children on complete *jowar* and rice diets, whether the difference in liver proteins on *jowar* and rice diets was significant, need for processing *jowar* to remove indigestible matter and thereby improve the digestibility of protein and calcium, experiment with other varieties of

rice consumed by the people, whether the bulky feces was all due to pentosans and fibre present in *jowar*, need for conducting experiments to assess the overall growth status of children instead of only carrying out metabolism studies, mode of incorporation of *jowar* in the diet of children, etc.

The President, in his concluding remarks, said that *jowar* was consumed widely in certain parts of the country like Maharashtra, Mysore and Andhra. It was, therefore, necessary to carry out investigations with the existing pattern of diets in different parts. Referring to the removal of husk from *jowar*, he said that this might result in heavy losses which would

not be liked in spite of the fact that it might improve the edible quality of *jowar*. *Jowar* can be made into flour and converted into shredded form or vermicelli which are more easily digested (as has been shown in earlier experiments) than *jowar* consumed in the form of balls or *rotti*. He stressed that efforts should be made to make *jowar* a better class of food easily acceptable and assimilable to the people. It would be worthwhile to select some varieties of *jowar* containing more of protein. He mentioned that it was necessary to design some palatable recipes using *jowar* which will be acceptable to rice eaters.

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Cream of tartar and its uses

E(IS) 60

Could you kindly let me know the difference between tartaric acid and cream of tartar? What are the uses to which they can be put to? (Parbhani, Central Railway).

Cream of tartar, also known as potassium bitartrate or acid potassium tartarate is the acid potassium salt of tartaric acid.

Cream of tartar finds application in the food industry in baking powder where its limited solubility in the cold inhibits the reaction with the bicarbonate until baking temperature is reached, thus releasing the major portion of the carbon dioxide at the optimum time. The slightly acidic pleasant taste of cream of tartar and its ability to partially invert cane sugar makes the compound useful as an addition to hard candy, syrups

especially grape flavoured and similar products where partial inversion prevents undesirable crystallisation.

Tartaric acid and cream of tartar are also used in the manufacture of starch jelly candies to modify the starch so that the product will flow freely while being cast. The tartaric acid is an acidulant in the manufacture of gelatine dessert and in fruit jellies especially in pectin jelly candies. Tartaric acid is also used in the manufacture of syrups especially which have grape flavour. It prevents the crystallisation of sugar.

Barley water

E(IS) 61

I shall be highly obliged if you can write to me the method of preparation of barley water. (Parbhani, Central Railway).

The following are the recipes for making barley water:

FORMULA 1

Barley	...	...	2 tablespoons
Water	...	...	2 quarts
Sugar	...	...	1 tablespoon

Wash the barley well, put the barley and water into a sauce pan and bring it to boil, then boil very slowly for two hours, strain it, add sugar and let it cool. Barley water is very cooling and nourishing. The barley may afterwards be used for a pudding or put into a soup.

FORMULA 2

Patent barley flour	...	1 tablespoon
Salt	...	A pinch
Cold water	...	A little
Boiling water or milk	...	$\frac{1}{2}$ pint
Sugar or wine	...	To taste

Mix the barley well with cold water until a smooth paste about the thickness of cream is formed.

Then add half pint of boiling water (or milk which is preferable). Put into an enamelled sauce pan, add sugar or wine to taste, simmer for 10 minutes, and stir all the time with a spoon.

Soyabean products

E (IS) 62

I have read an interesting article recently about the high food value of soyabeans. Would you please provide me particulars regarding the nutritive value of soyabeans and the products that can be prepared from it for consumption? (Jubbulpore).

Soyabean has a high nutritive value as given below:

Values per ounce (28.35 g)

Moisture	...	2.3 g.
Protein	...	12.3 g.
Fat	...	5.5 g.
Mineral matter	...	1.3 g.
Fibre	...	1.1 g.
Carbohydrate	...	5.9 g.
Calcium	...	70 mg.
Phosphorus	...	200 mg.
Iron	...	3.3 mg.
Calorific value	...	123
Vitamin A	...	202 I.U.
Vitamin B ₁	...	207 µg.
Nicotinic acid	...	0.7 mg.
Riboflavin	...	216 µg.
Vitamin C	...	Nil

The following are the products that can be manufactured from soyabean:

1. *Soyabean flour*: This can be mixed with wheat flour in the ratio of 1:4 while making *chappattis*. These are extremely nutritious and particularly beneficial for diabetic patients. It is a good source of protein, fat and mineral matter. It is rich in B-complex vitamins also. Biscuits and cakes also can be made out of this flour. The bean is slightly bitter and as such the flour is commonly steamed before using. This process improves the nutritive value of the protein and the keeping quality of the flour.

2. *Soyabean milk*: The soyabeans are first thoroughly washed and then soaked in water for

several hours, skins are rubbed off, after which they are ground through a stone mill and the crushed mass is strained through a cheese cloth, then diluted with about three times the amount of water and boiled. After boiling the product is again strained and the milk is filled in containers. This is used as a beverage and for cooking.

3. *Soyabean curd*: The proteins from the soyabean milk previously prepared are precipitated by adding acids or salts and then boiling. After the curd settles, the supernatant liquor is removed and the curd is placed on cloth spread on wooden trays and pressed to remove sufficient water. This curd will have the consistency of cream cheese and is cut into small squares. This is well known as 'Tofu' is Far Eastern countries. This can be fried in deep fat and used in a variety of dishes. This is also cooked with fish, meat, vegetables, etc. This can also be used in preparing dishes such as omlets, stuffed peppers, salad or sandwich filling, etc. Besides these, a predigested protein food known as soya sauce can also be prepared.

Storage of potatoes

E (IS) 63

We learn that the hormone, 'Mena' is used in the storage of potatoes and shall be glad to receive details about the level at which it is to be used and the mode of its use. (Saharanpur).

The hormone, Mena, is used to inhibit the sprouting of potatoes during storage. The treated potatoes are good for table use and will not be suitable for seed purposes. Mena is methyl alpha-naphthalene acetate or methyl ester of alpha-naphthalene. It is used to the extent of 0.5 per cent. With this treatment, the potatoes can be stored for a period of 8 months at 35-38°F having 90-95 per cent relative humidity. It is not manufactured in India but has to be imported. However, you may contact Messrs. Im-

perial Chemical Industries (India) Private Ltd., Bombay-1, for the same.

Packing of walnut kernels

E (IS) 64

The present method of packing walnut kernels followed by the various shippers for export trade is to use soft woodcases which are interlined with craft and butter paper. We are receiving complaints about the goods reaching the destination sometimes infested and sometimes getting oily and/or rancid. Would you kindly suggest some improved packing method to prevent the above defects? One of our buyers abroad has suggested to us to pack the kernels in tin containers under inert atmosphere. Please advise us on the feasibility of this method. (Delhi).

We would suggest to you the use of 300 gauge polyethylene bags for packing the walnut kernels and properly sealing the bags by heat. This heat-sealed polyethylene bag can further be packed in the traditional dealwood case properly lined with union kraft paper. The impregnation of the dealwood case with lindane to protect the walnut kernels packed in 300 gauge polyethylene paper from Calandra can also be done.

Regarding the feasibility of packing the walnut kernels under inert gas, we have to state that if the kernels have a very low moisture content (3-4 per cent) and are free from initial infection, they can easily be packed in hermetically sealed tins under carbon dioxide. After packing the kernels in the tin, a vacuum of about 26 inches in the tin has to be created by means of a vacuum pump and this vacuum has to be filled by means of carbon dioxide to normal atmospheric pressure. In this case, no fumigation before or after the packing is needed.

No work has, however, been done in this Institute on the inert gas packing of walnut kernels in hermetically sealed containers.

Sourness and staleness of bread E(IS) 65

I have often come across certain defects such as sourness and staleness in loaf bread. Kindly let me know how this can be remedied and a bread free from the above drawbacks can be prepared. (Bellary).

The sourness of bread is due to excessive fermentation which is often encountered in hot weather. This is recognised by smell and bound appearance of the loaf. In order to avoid the sourness, the fermentation has to be properly controlled. Staleness of bread is not only due to quality of gluten but also is a phenomenon associated with changes in starch. Staleness can be retarded by keeping bread at a warm temperature for some hours or by keeping it at very low temperature. The former storage at warm temperature results in ropy condition of the bread. To avoid staleness, proper water absorption, correct fermentation and proper mixing of the dough are very essential. Dough prepared should not also be too warm. Similarly tight dough, over-ripe or over-proved dough should be avoided. To avoid staleness, use of anti-staling agents or softeners is desirable. 0.15 per cent of surface active agents such as glyceryl monostearate or 0.5 per cent of polyoxy ethylene stearate or sodium propionate based on flour can be used. As regards their permissibility by law, you may refer the matter to the Director-General of Health Services, Government of India, New Delhi.

Preparation of home-made cheese

E(IS) 66

May I approach your valuable Institute for advice and details about the preparation of a real home-made cheese. Wherefrom can we get rennet for cheese-making? (Bellary).

The details of the process of making home-made cheese are as follows:

Mix equal proportions of fresh milk and milk allowed to set for

ripening overnight in a cool place. The mixture must have sweet taste. Heat milk to 86° F. Add cheese colour if desired. The colour should be dissolved in a little bit of water and then added. Add rennet tablet dissolved in cold water to the pot containing the milk. This milk pot, while adding the rennet solution, is held in another container containing warm water (89-90° F). Stir until completely dissolved. Allow to stand until a firm curd forms (about 35 to 45 minutes). The firmness of the curd can be tested by inserting a finger at an angle and lifting it. If the curd breaks clean from finger, it is ready for cutting. Cut the curd two-ways, vertically and then two ways at an angle and stir it for 15 minutes by hand. Later, warm slowly for about one hour to 102° F, raising the temperature by about 1½ degree every 5 minutes. Stir frequently and, if necessary, heating can be done a few degrees above 102° F until the curd holds its shape and readily falls apart when held on hand for a few seconds without squeezing. Stop heating and stir occasionally for one hour. Then pour the curd into cheese cloth. Hold two corners of the cloth in each hand and let curd roll back and forth without sticking together for 2-3 minutes and allow the whey to run off. Salt the curd and mix well. Tie the four corners of the cloth cross-wise forming curd into a ball. Hang up for ½ to ¾ hour to drip off. Later, dress the cheese by folding a long cloth into a bandage about 3" wide and wrap tightly around ball, forming it into a round shape. Press the cheese with the help of two bricks placed on top of cheese cloth. Turn cheese over at night and put two more bricks. Remove the pressed cheese from the cloth next morning and place it on a board for half-a-day turning occasionally until the rind is completely dried. Then dip in paraffin, i.e., heat in a deep pan over boiling water to 210-220°F. Dip first one half, hold for a minute, then dip another half. Then store in a

cool, clean place. Turn over each day for a few days and then 2-3 days a week. The cheese is fit for eating after 3-4 weeks.

Processing of turmeric

E(IS) 67

We learn that your Institute has recently developed a new method for processing of turmeric tubers and colouring them. We shall be grateful if the detailed particulars are furnished to us. (Dharwar District).

As a result of studies conducted at our Institute, it has been found that cooking of the fresh tubers in 0.05-0.1 per cent solutions of lime water, sodium carbonate or sodium bicarbonate in quantities just to cover the tubers, imparts the same orange yellow tinge to the core of the tuber, as the traditional cordung extract.

If lead chromate is to be eliminated for colouring purposes, the orange tint of turmeric powder has to be modified to yellow colour. In our initial experiments, this was achieved by the use of hydrochloric acid and sodium bisulphite. Sodium bisulphite (20g.) and concentrated hydrochloric acid (20 cc.) added to the quantity of conventional emulsion of turmeric powder, castor seed paste and alum (omitting chemichrome) needed for 150 lb. were found adequate for colouring this quantity of tubers.

Dehydration of potato chips

E(IS) 68

We would feel highly grateful if you could send us details regarding the preparation and dehydration of potato chips. (New Delhi).

In assessing the value of commercially grown varieties of potatoes for drying, account must be taken of factors like culinary qualities, tendency to blacken, the content of dry matter, the amount of waste during peeling and trimming, yield, nutritive value, susceptibility to disease and to various defects such as hollowness. So

far the King Edward variety has proved the best all round quality. The method of dehydration is as follows:

Wash, peel and trim the potatoes. Cut the peeled potatoes into strips, cubes or slices having a size of $3/16 \times 1/4$ inch in cross section. In the case of chips, the thickness should be $1/8$ inch to $1/16$ inch. Wash the slices because loose starch gelatinises during scalding and if much is present, the strips stick together during drying and are gelatinous when reconstituted and cooked. The potatoes after peeling are scalded for 3-7 minutes. About 0.25 per cent of sodium sulphite solution can be added to the scalding water. Cooling in water after scalding is not

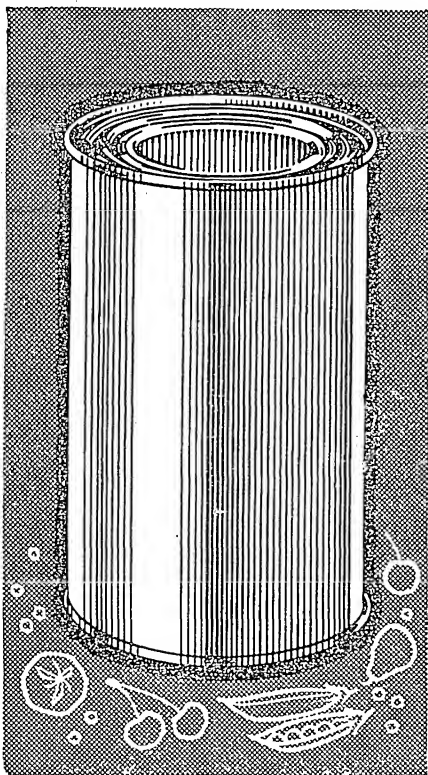
found to be desirable. In the case of potato chips they are steamed for 3-4 minutes and then soaked in 0.25 per cent potassium metabisulphite solution for 10 minutes. Later on, they are drained and are ready for drying. For a pound of slices, one half pound of solution containing 0.25 per cent of potassium metabisulphite is desired.

The potatoes can be dried between temperatures of 145° to 155° F within 8-12 hours. In case of chips meant for frying later on, the drying period will be 6-8 hours. In the cross-flow cabinet drier, the drying of potato chips having varying thickness from $1/8$ inch to $1/16$ inch can be done within six hours. The initial temperature

is 85° C and is maintained for one hour. Later on, the temperature is maintained at 80° C for another hour. The temperature is then maintained at 70° C for 2 hours while for the next two hours, the temperature is maintained at 60° C.

The moisture content of the dried potato strips should not exceed 7 per cent. The drying ratio is about 8-9 of raw untrimmed to 1.

The potatoes properly prepared and dehydrated should be white in colour, translucent and should be dried until hard and brittle. When broken between the fingers the fractures should be sharp and the interior of the pieces should be flinty and not mealy.



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Notes and News

STATISTICAL NOTES

All-India Final Estimate of Crops for the year 1959-60

Crops	Area (thousand acres)		Production (thousand tons)	
	1959-60 Final estimate	1958-59 Partially revised estimate	1959-60 Final estimate	1958-59 Partially revised estimate
CEREALS				
Rice ...	81,343	81,437	29,338	30,354
Wheat ...	31,508	31,141	9,734	9,772
Jowar ...	41,602	42,584	7,866	8,714
Maize ...	10,457	10,457	3,615	3,381
Barley ...	8,220	8,243	2,605	2,672
Small millets ...	12,340	12,417	2,012	2,072
OILSEEDS				
Linseed ...	3,921	3,965	425	447
Sesamum ('Til or Gingelly) ...	5,510	5,500	392	511
Castor seed ...	1,178	1,203	108	112
Rapeseed and mustard ...	7,167	6,021	1,037	1,025

(Economic and Statistical Adviser, Ministry of Food & Agriculture Government of India).

NEWS BRIEFS

Milk substitute: A milk substitute which is an extract from soybeans is being produced in Java. Developed by United Nations agencies, the product has sesame seed added, along with vitamins and minerals. It resembles milk, though its nutritive value is less than that of cow's milk. But Java has no room for cows and imported milk is too expensive. A new dehydrated soybean milk plant in Java is producing two and a half tons a day and cannot keep pace with demand. It was modelled on a California plant which makes a similar product for children allergic to milk. Chocolate or vanilla flavour is added to make the product acceptable.

It took years to develop a milk substitute for South East Asians. For instance, peanut oil was first added to the soybean extract but it tended to turn the product rancid. Sesame extract, high in amino acids and fat, worked (Food in Canada, April 1960, p. 7).

New method of tenderizing beef: Measured amounts of natural food enzymes are injected to cattle just prior to slaughter to effect tenderization of the beef. The amount of enzyme is automatically introduced into the vascular system, varying only with the weight of the live animal and the grade. Swift and Company, who have developed the new technique have given the name 'Pro Ten' to the enzyme-tenderized beef. In addition to tenderness, the new process is claimed to eliminate the need for freezing to arrest the action of enzyme. Actually, tenderizing does not take place until the housewife prepared the product in the oven. This helps in handling the tenderized carcass through normal refrigeration channels. The new process also avoids shrinkage losses and discolouration, which are generally associated with aging methods (Meat, June 1960, p. 33).

New food: A Chicago food specialist has reported that a mineral mixed for use as a soil conditioner

and building material is not only edible but might reduce the dangers of radio active contamination in the human body. The complex mineral is vermiculite, more commonly known as black mica. Vermiculite does not impair the assimilation of vitamins and might contribute significantly in reducing calories for the control of obesity (Meat, June 1960, p. 97).

High-conversion corn syrup for candy making: High-conversion corn syrup, is most applicable to use in all soft candies in which prevention of moisture loss and the keeping of a soft, tender texture are desired and a long shelf life is important. Soft candies produced with high-conversion syrup differ from those made with other syrups primarily because of differences in the sweetness, viscosity, solids concentration, hygroscopicity, and boiling points of these syrups. These differences make it necessary to adjust formulas and cooking temperatures when changing to high-conversion corn syrup, but such adjustments are more than justified by the benefits to be gained.

The enzyme-conversion process for making high-conversion corn syrup was developed just over 20 years ago. Since that time, the use of this syrup in candies has steadily expanded. The functions of this unique type of corn syrup provide greater ease of handling, improved body and texture, better flavour, longer shelf life, and lower costs (Manufg. Confectr., April 1960, p. 55).

New French tomato product: A firm in the south of France is now producing a tomato powder which is claimed to retain all the colour and qualities of tomatoes. The powder is stated to be in keen demand from companies using it to prepare dehydrated soup. For individual users, the new concentrate is stated to have the advantage of keeping indefinitely, and can thus be used as needed

in all recipes calling for tomatoes or tomato paste (*Food Technol. Austr.*, February 1960, p. 102).

Sulphuring fruits: It has long been customary in the dried tree fruits industry to treat the fresh fruit with sulphur dioxide to retard darkening of the fruit during the drying process, and while the dried fruit is in store. The usual method of sulphuring is to expose the fruit to fumes from burning sulphur in an enclosed space into which enough air can enter to support combustion of the sulphur. This procedure results in the dried product containing sulphur dioxide at many different levels, which often depart greatly from the Australian permissible upper limit of 21 grains per pound or 3000 parts per million.

Over recent years, a study has been made at C.S.I.R.O. Division of Food Preservation and Transport, Homebush, of factors affecting the absorption of sulphur dioxide by fruit tissue and its retention during subsequent drying. Basic information has been obtained by using a small recirculatory tunnel in which dry-bulb temperature, air speed and sulphur dioxide concentration could be varied. The thermal conductivity of the circulating air stream varied with its sulphur dioxide content, and this was used to control the concentration of the latter. Materials used in the construction of the tunnel were waterproof plywood coated with sulphur-resisting lacquer and stainless steel, or plastic coated with sulphur-resisting lacquer and stainless steel, or plastic-coated mild steel.

The basic information obtained from the tunnel experiments has been applied to pilot-scale operation, and the results suggest that the method can be used commercially. The pilot-scale equipment consists of a box in which two tiers of trays are fitted on wooden runners. Leakage at the door is prevented by Neoprene gasketing. Sulphur dioxide from a cylinder of the compressed gas is introduced

into the box through a simple flowmeter and exposure continues for a fixed time. During a run, the air and sulphur dioxide in the box are well mixed by means of a stainless steel fan. The concentration of sulphur dioxide in the box falls during a run because it is absorbed by the fruit but, by using fixed loadings of fruit and introducing the gas at fixed rates, the absorption levels in fruit can be kept within a narrow range. The interior of the box is protected with a plastic finish, and metal parts exposed to sulphur dioxide are made of stainless steel (*Food Technol. Austr.*, February 1960, p. 109).

New protein food for Nigeria: A new protein food called *Amama* is now being marketed in Nigeria where it will be used to combat the high death rate among children due to protein deficiency. The product, a pink powder to be added to a child's food, consists of ground-nut flour to which carefully judged proportions of dried yeast, milk casein, sugar, five minerals and seven vitamins have been added. *Amama* is manufactured by Glaxo Laboratories (Nigeria) Ltd., at Apapa, a subsidiary of Glaxo Laboratories Ltd., Greenford, England.

The emphasis in the application of this protein-rich supplement is on the prevention of the protein deficiency known as kwashiorkor among children in the age group of six months to school age. The protein supplement would be added to the diet of young children at the rate of one ounce per day, and is being distributed in 8-day packets containing 8 ounces of the supplement, retailing at about 1sh. 6d. (*Food Technol. Austr.*, March, 1960, p. 162).

Infra-red blanching: Canadians are conducting a great deal of research into the use of infra-red heat in the blanching of fruits and vegetables preparatory to freezing and canning.

A scientific team led by Dr E. A. Asselbergs of the Plant

Research Institute, Canada Department of Agriculture, has proved that infra-red lamps are superior to steam-water in the blanching of apples, celery, peas and potatoes.

Some of the benefits are: For apples, celery and peas, infra-red reduces the amount of water, thereby cutting handling and storage costs; does not leach out flavour and nutrients, as in the case of water or steam; and improves texture, flavour and appearance. For potatoes, it reduces the fat absorption in french fries and allows better recovery of the raw material.

Canada pioneered in this field in 1955 and today has the only known laboratory experimenting with infra-red fruit and vegetable blanching. Infra-red blanching of celery is being carried out on a commercial basis by a southern Ontario food processing company. Domestic celery is prepared in September for manufacturing use during the winter avoiding the high cost of importing. A 30-ft. infra-red tunnel can process more than 1,000 lb. of the finished product per hour.

Apple peeling by infra-red heat is another technique under experimentation at the federal laboratory. Researches found that the loss of weight through peeling by this process was about two and a half per cent, compared with 15-18 per cent through the use of mechanical peeling machines.

Three major types of infra-red radiators being used in the experiments are calrods, quartz tubes and quartz lamps. The main difference lies in the operating temperature of the filament. In the first two types, the operating temperature is between 1,400 and 1,800 degrees F. while in the third type the filament temperature is 4,000 degrees F.

Infra-red heat is not a sure method of blanching all vegetables. For example, it has so far been unsuccessful with asparagus, turnips and carrots. It is hoped that as more basic information becomes available the difficulties met with in these vegetables will be overcome (*Food*, March 1960, p. 97).

Sterile packing 'tetra' way: Whole, sterile milk in paper containers—newest concept of aseptic packaging—is a startling development offering big advantages. This has been made possible by a revolutionary, low-cost, laminated paper and a modification of a standard Tetra-Pak machine to fabricate a sterile package with hermetic seams. The outstanding advantage of the new package is economy, as it shows nearly 50 per cent saving over the conventional containers. Tetrahedron-shaped container is made from the laminated paper by heat sealing. It is then filled with the material and sealed hermetically in inert gas such as nitrogen. Sanitizing the interior surface of the container with chlorine helps in guarding the product against contamination and thus eliminates the need for thermal sterilization which would damage the paper.

This type of container can also be used for packing tomato juice, paste and puree; coconut juice, many fruit and berry juices or nectars; low sodium milk; egg nog; 3-1 milk concentrate; baby formulas and soups (Abstracted from *Food Engng.*, March 1960, p. 48).

FOREIGN PATENTS

820,726. *Improved tea crushing apparatus:* Unbroken tea leaf is fed through a pair of neoprene

or rubber rolls driven in opposite senses at different peripheral speeds; each of these rolls has a number of continuous circumferential flanges interdigitating with the flanges of the other roll, but not quite touching them. The crushed leaf is then fed to an oscillating inclined screen.—Patented by William Angus Kerr., Kenya Colony (*Coff. & Tea Ind.*, May 1960, p. 46).

2,902,368. *Preparing of tea concentrates and powders:* Extract tea leaves in an equilibrium batch-wise countercurrent process having two or three stages in which the fresh leaves are introduced at the initial stage and fresh water at the final stage. Substantially all of the essential ingredients of the leaves (both the volatile aromas and the soluble solids responsible for favourable flavour and colour) are recovered without excessive dilution of the extract, that is, with a high concentration of soluble tea solids in the extract.—Patented by Thomas J. Lipton, Inc. (*Coff. & Tea Ind.*, May 1960, p. 46).

576,282. *Improved tea concentrate from green leaves:* A water extract of the green leaves is heated to 80-90°C in contact with an oxygenous atmosphere for at least 1 hour so that water soluble constituents are oxidized.—Patented by Transcontinental Development Co. (*Coff. & Tea Ind.*, May 1960, p. 46).

2,915,405. *Frozen food indicator:* A device to be embedded in a package of food to be frozen that will indicate thawing is the object of a recent patent. Device comprises elongated transparent container having slidable piston situated over a spring that is biased to exert force to advance the piston, and a liquid whose freezing point is above that of the food. Liquid expands on freezing and releases piston from its seat but confines the spring while product remains frozen. When thawing occurs, spring is released (*Food Engng.*, March 1960, p. 117).

2,916,378. *New corn chip process:* Improving the quality of corn chips is the object of a recent patent. In the process, yellow corn (10 per cent moisture content) is heated to 170°F, then allowed to cool to room temperature. Corn is washed, drained and ground to form a dough that can be washed through a No. 20 screen-75 per cent through No. 325 screen. Moisture content of dough is adjusted to 50 per cent then it is kneaded between oppositely rotated rollers spaced .014 inch apart. Dough is stripped from rollers, cut to desired size pieces and dried at 675-725°F for 30 seconds. Finally, the dried strips are fried for 30 seconds in shortening at 370°F. (*Food Engng.*, March 1960, p. 117).

Chewer's favourite

ASOKA SCENTED BETELNUT POWDER

Manufacturers: M. K. Krishna Chetty, Post Box No. 106, Coimbatore

Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Role of antioxidants in the storage of Indian mandarin oil, by Parekh, C. M., Pruthi, J. S., Jain, N. L. and Girdhari Lal, *Indian Perf.*, 1959, 3, Part II, 87.—A detailed study on the role played by various antioxidants against agencies like oxygen, moisture, light and temperature causing deterioration in mandarin oil indicated that the maximum deterioration occurred in the presence of oxygen or air, the next being moisture and light. Higher storage temperatures further accelerated the oxidative reactions caused by air, light and moisture.

Of the six antioxidants studied, *viz.*, NDGA, α -tocopherol, BHA, octyl gallate, propyl gallate and a mixture of hydroquinone and wheat germ oil, the addition of NDGA at .05 per cent w/v level was found to offer the greatest protection to the mandarin oil against its deterioration during storage, the next in order of merit being α -tocopherol and BHA.

Effect of added ascorbic acid, amino-acids and minerals on browning in Coorg orange juice and squash and model systems at ordinary and elevated temperatures, by Siddappa, G. S., Bhatia, B. S. and Girdhari Lal, *Indian J. appl. Chem.*, 1959, 22 (5-6), 199.—In natural Coorg orange juice and squash and also in model systems corresponding to these, added ascorbic acid is the most important single factor concerned in their browning during storage, and this is already well known. Browning is considerably more in the case of lots preserved by pasteurisation than in the case of those preserved with SO_2 . The addition of amino-acid mixture up to 400 ppm does not have any

further marked effect on browning that occurs in the presence of ascorbic acid. Neither the addition of minerals present in the orange nor of the acid hydrolysate of the rag, does influence browning to any extent.

In model systems, autoclaving at 10 lb. p.s.i.g. results in browning of the sugar solutions, browning being more marked in the alkaline medium than in acid or neutral media. Except in the highly acid (pH 0.65-1.09) and highly alkaline (pH 7-13) ranges, there is very little browning in glucose and sucrose solutions. Among the common sugars, galactose is the most susceptible and sucrose, the least susceptible to browning on heating. In the case of glucose solution, ferrous iron increases browning, while metallic tin and SO_2 decrease it.

The relative effects of enzymatic and physical changes during storage on the culinary properties of rice, by Desikachar, H.S.R. and Subrahmanyam, V., *Cereal Chem.*, 1960, 37 (1), 1.—The amylases were destroyed during the first 5 minutes of cooking milled rice grains, but the solids extracted by the cooking water continued to increase as cooking progressed. The inhibition of amylase action by mercuric salts did not improve the cooking quality of new rice; treatment with formalin or steam-curing of the freshly harvested rice did. The cooking of old rice in amylase solution did not affect its cooking quality.

In aqueous suspensions, fresh-rice flour took more time to settle and left the supernatant liquid more turbid than old-rice flour under similar conditions.

The physical changes that occur during storage have to be considered in explaining the improved cooking quality of old rice.

The effect of the degree of polishing of rice on nitrogen and mineral metabolism in human subjects, by Rao, G. R., Desikachar, H.S.R. and Subrahmanyam, V., *Cereal Chem.*, 1960, 37 (1), 71.—Negative calcium balances were recorded in human subjects when brown (unpolished) rice or rice polished to remove 2.9% of the brown rice was fed as the cereal portion in a poor vegetarian diet. Under similar conditions, rice polished to remove 4.1 or 6.3% of the brown rice produced slight positive calcium balances. In spite of its higher protein and phosphorus content, the brown rice did not produce higher nitrogen or phosphorus balances than the polished rice samples.

Rice polished to remove 4.1% of the brown rice represented a *via media* stage of polishing with 1.7% per g. of thiamine and could be recommended for consumption by rice eaters. The exclusive consumption of brown rice in diets containing marginal or sub-marginal amounts of calcium is not to be recommended as it may produce negative calcium balances.

Determination of the uric acid in wheat flour infested by *Tribolium castaneum* Duv., using paper chromatography, by Venkatrao, S., *et al.*, *Cereal Chem.*, 1960, 37 (1), 93.—The uric acid present in infested wheat flour was separated by paper chromatography and quantitatively estimated using Benedict's uric acid reagent. The results agreed with those obtained by a direct colorimetric method of determining

uric acid in protein-free aqueous extracts of infested flour. The uric acid content in the infested flour increased steadily with the progress of infestation. No uric acid could be detected in the extract of control uninfested flour. The protein-free aqueous extract of control uninfested wheat flour, however, contained small amounts of substances (other than uric acid) which reacted with the Benedict's uric acid reagent and yielded an 'apparent' uric acid value. This value was low, as compared with those found in the infested flour.

The effect of infestation by *Tribolium castaneum* Duv., on the quality of wheat flour, by Venkatrao, S., *et al.*, *Cereal Chem.*, 1960, 37 (1), 97.—The changes occurring in hard Indian wheat flour (75 per cent extraction) subjected to infestation by *Tribolium castaneum* Duv., in 4-gal. tins provided with lever lids, at a temperature of $85 \pm 5^\circ$ F and a relative humidity of 70-75 per cent, were studied during a period of 5 months. The uric acid content (derived from insect excreta) of the infested flour was proportional

to the insect population and served as a good index of the unhygienic condition in the flour due to the presence of insect excreta. A marked increase in fat acidity and a decrease in the thiamine content were observed in the infested flour. The gluten obtained from flour infested for 4 to 5 months was brittle. The values for the wheat meal time test gradually decreased with the progress of infestation, indicating a deterioration in the quality of gluten. The loaf volume of the bread also gradually decreased as the infestation progressed. Organoleptic evaluation revealed that bread made from flour infested for more than one month had an off-flavour and bitter taste and was not acceptable.

The uninfested control flour remained in good condition throughout and the bread made from it was quite acceptable.

The metabolism of nitrogen, calcium and phosphorus in rats fed on poor vegetarian diets containing varying proportions of ragi and rice, by Kurien, P.P., *et al.*, *Indian J. Physiol. all. Sci.*, 1960, 14 (1),

13.—The effect of replacing rice in a poor vegetarian rice diet either partially (at 25 or 50 per cent levels) or completely by ragi on the metabolism of nitrogen, calcium and phosphorus was studied in albino rats. The mean daily retention of nitrogen in growing rats was higher on diets containing 25 per cent of ragi than that observed on other diets. The mean daily retention of calcium in growing rats on rice diet was only 0.43 mg. While that on diets containing 25 per cent, 50 per cent and 100 per cent ragi were 7.6 mg. 10.9 mg. and 13.5 mg. respectively. The results show that replacement of rice in the diet by ragi even to the extent of 25 per cent will be adequate to make up the calcium deficiency in poor rice diets. The mean daily retention of phosphorus in growing rats on poor rice diet was 3.3 mg. as against retention of 6.3, 7.0 and 7.7 mg. on diets containing 25 per cent, 50 per cent and 100 per cent ragi. The results obtained in adult rats on the different diets were somewhat similar to those observed in young rats.

PART II (Indian)

Stability of colour developed by the Sakaguchi reaction of arginine, by Bhattacharya, K. R., *Ann. Biochem. exptl. Med.*, 1960, 20 (3), 57.—The colour produced with arginine by the Sakaguchi reaction, in the urea method, fades progressively if developed in solution, but remains stable if developed on filter paper. Alkali has a moderate destructive action on the colour; bromate is without any effect. Substitution of metabisulphite (or thiosulphate) for the urea results in stabilization of colour. Stability is also achieved in the urea method if the pH of solution is subsequently reduced by the addition of bicarbonate. Time taken by an excess of urea to destroy a small amount of hypobromite completely is appreciable (about 40 min. at 0° , 7-8 min.

at $30-31^\circ$). Metabisulphite and thiosulphate require only a few seconds for a similar purpose.

It is suggested that the protracted survival of some hypobromite in the face of urea and its 'activation' by the free alkali are the main causative factors leading to fading of colour in solution. The quick conversion of free alkali into carbonate in air is presumably the chief reason of colour stability when it is developed on filter paper.

It is concluded that the use of urea in Sakaguchi reaction is feasible only if it is used prior to hypobromite. The use of metabisulphite as a substitute for urea in the method is suggested.

A simple physico-chemical estimation of thiamine, pyridoxine and nicotinamide in

presence of riboflavin and panthenol (Part I), by Bardhan, D. K., Bhattacharya, R. N. and Dutta, S. K., *J. & Proc. Inst. Chem.*, 1960, 32 (2), 86.—A simple physico-chemical method for the simultaneous estimation of thiamine, pyridoxine and nicotinamide in presence of riboflavin and panthenol has been developed. The method comprises of two steps: (i) removal of riboflavin with ion exchange resin under a specified condition and (ii) spectrophotometric analysis of these vitamins in the percolate. Panthenol having no absorption in that region does not interfere. Results have been discussed to indicate the limitation of this method.

A simple physico-chemical estimation of thiamine, pyridoxine and nicotinamide in

presence of riboflavin and panthenol Part II, by Bardhan, D. K., Bhattacharya, R. N. and Dutta, S. K., *J. & Proc. Inst. Chem.*, 1960, 32 (2), 91.—B-complex vitamins have been separated by paper electrophoresis and subsequently estimated after elution by spectrophotometry. Presence of other vitamins and preservatives did not interfere. Electrophoresis was carried out at 200 volts with 10 mA for four hours in Sorensen's citrate-hydrochloric acid buffer of pH 4.0 using specially washed Whatman No. 1 filter paper as a supporting medium.

BIOCHEMISTRY AND NUTRITION

Effect of alpha-tocopherol on experimental atherosclerosis, by Chakravarti, R. N., Balakrishna and Zaidi, *Indian J. med. Res.*, 1960 48 (3), 356.—Experimental atherosclerosis was produced in rabbits by prolonged cholesterol feeding and the effect of *dl*, α -tocopherol on its extent and severity was studied. Visual assessment of the involved area of aortic endothelial surface showed slight increase. There was, however, marked enhancement in the severity of atheroma, determined by the measurement of the height of the plaque. It is therefore, suggested that for the assessment of the degree of atherosclerosis measurement of the severity of atheroma is of greater significance than its extent because it is usually related to occlusive processes in the vessels. α -tocopherol in therapy cholesterol atherosclerosis appears to increase this occlusive process. The administration of α -tocopherol to cholesterol fed animals produced marked increase of cholesterol content of the aorta. It is suggested that this change helped in the enhancement of the atherosclerotic lesions.

Studies on lipid metabolism. Part III. The Effect of acetoacetate on the rise of blood and tissue lipids in rabbits and its prevention by glucose cy-

cloacetoacetate, by Nath, M. C. and Saikia, A., *Indian J. med. Res.*, 1960, 48 (3), 382.—Prolonged injection of sodium salt of acetoacetate to the rabbits raised the blood and tissue cholesterol level. Rise of blood cholesterol level is found to be proportional to the dose of acetoacetate. There is also simultaneous decrease of blood ascorbic acid and blood reduced glutathione levels. On administration (both injection and feeding) of hydrolyzed GCA along with the injection of acetoacetate the elevated blood and tissue lipid levels have been checked and blood ascorbic acid and glutathione level increased.

COCONUT

Some aspects of technological research on coconut and its products, by Rajasekharan, N. and Pandalai, K. M., *Indian Coconut J.*, 1960, 13 (2), 80.—The present paper is a review of the literature available on some of the technological problems on the processing and utilization of coconut and its products. It covers the following points: production of coconuts in India; desiccated coconut; processing and storage studies on copra; processing of coconut oil by different methods; refining and utilization of the oil, coconut oil cake; use of coconut meat in human diet; preparation of milk substitutes from coconut; composition, therapeutic properties and use of coconut water; production and utilization of coconut shell; utilization of coconut neera; coconut leaves and shed buttons. 7 references.

K.L.R.

MICROBIOLOGY

Factors influencing endotrophic sporulation in aerobic sporeforming bacilli, by Iyer, V. and Kanga, D. H., *Proc. Indian Acad. Sci.*, 1960, 51 (3), 133.—The ability of strains of representative species of sporeforming bacilli to sporulate endotrophically in distilled water has been demonstrated.

The degree of sporulation which a bacterium may undergo is a strain specific character but some species are more capable than others. The effect of various exogenous compounds on the phenomenon has been studied. It has been observed that various metallic salts, organic acids and autoclaved carbohydrates inhibit sporulation at concentrations that are growth inhibitory in nutrient media. It has been postulated that all or most growth inhibitory substances may at similar or lower concentrations inhibit endotrophic sporulation. A hitherto accepted procedure of sterilisation, the autoclaving of concentrated aqueous solutions of sugars, has been found to enhance the ability of the sugar to inhibit sporulation. None of the growth factors tested had any effect on sporulation.

OILS AND FATS

The utilisation of custard apple seed and oil, by Bhojraj Naidu, N., *Indian Oil & Soap J.*, 1960, 25 (10), 350.—Custard apple trees grow wild extensively in forest areas yielding about 1.5 lakh tons of fruit and 336 lakh pounds of seeds. The price of the latter would be Rs 30 lakhs. The seeds have an oil content of 27 per cent and at least 50 lakh pounds of oil and 200 lakh pounds of cake containing 4.3 per cent nitrogen could be obtained by crushing the seeds. The shell and the kernel account for 31.5 and 68.5 per cent respectively of the seed. The kernel contains 39.5 per cent of a brown-coloured non-drying oil with an iodine value of 83.3. The fatty acid composition of the oil is as follows: myristic, 0.3; palmitic, 12.5; stearic, 8.9; arachidic 1.8; hexadecenoic, 2.3; oleic, 54.2; and linoleic, 20.0 per cent. The oil is found to be similar to groundnut oil except for the presence of a toxic principle. The method of decortication of the seeds and expression of oil and its properties have been described. The crude oil have insecticidal action.

comparable to DDT. The oil can also be used for soap making and as a plasticiser in alkyd manufacture. The seed oil can be detoxified by alkali treatment and thereafter used for edible purposes. The press cake contains about 21 per cent protein and can form a dietary supplement in animal feeds. The main difficulty, however, in the utilization of custard apple seeds is one of collection which requires proper organization. Fruit preservation factories using the fruit can with advantage also process the seeds obtained as a by-product.

K.L.R.

SPICES

Standards for mustard seeds, by Mitra, S. N., *et al.*, *J. & Proc. Inst. Chem.*, 1960, 32 (2), 79.—Mustard is widely used as spice and condiment in many preparations. The present standards for mustard seeds as per the Prevention of Food Adulteration Rules, 1955, were felt as not quite rational particularly with respect to total and acid-insoluble ash and volatile oil. Thirteen samples of different varieties of mustard seeds obtained from the growing states and five authentic market samples have been analysed for the above three constituents following the A.O.A.C. methods. The maximum, minimum and average values are reported as follows: total ash—4.60, 3.47 and 3.86; acid-insoluble ash—0.78, 0.06 and 0.39; and volatile oil—0.62, 0.25 and 0.40 per cent respectively. The results clearly show that the present upper limit of 1.5 per cent for acid-insoluble ash is very much

higher than the maximum figure of 0.78 per cent obtained in this study and needs to be brought down as otherwise it may facilitate wilful adulteration with sandy and siliceous matter. It is also found that the present standard for volatile oil, namely, a minimum of 0.6 per cent is definitely stringent and needs modification as out of the 18 samples analysed, only one had 0.62 per cent volatile oil and the rest had values lower than 0.6. Only one sample had a value of 0.25 per cent, 9 samples having between 0.30 and 0.38 and 7 samples between 0.44-0.48 per cent. A minimum volatile oil content of 0.3 per cent for Indian mustards might be more appropriate for the legal limit as also shown by earlier workers.

TEA

Review on aroma of black tea, by Sen, N. K., *Indian Oil & Soap J.*, 1960, 25 (8), 288.—In this note, the author has briefly reviewed the present status of the aroma of tea, which is a combined effect of many constituents. The aroma of green and black teas sharply differ. The mossy smell of green tea is believed to be due to the presence of hexenal. Some of the components occurring in green leaves are absent in black tea. The essential oil of black tea is formed only during the fermentation process in the manufacture. Black tea essential oil has been found to contain large amounts of hexanol besides containing traces of phenyl ethyl alcohol, citronellol, geraniol (traces), methyl salicylate, phenyl acetic acid, salicylic acid

and aldehydes like isovaleraldehyde and butyraldehyde. A few other compounds present in it are still unidentified. The compounds like phenyl alcohol, citronellol, geraniol phenyl acetic acid which contribute the rosy aroma, are found in both green and tea essential oils. It is, therefore believed that the distinction in the aroma of the two types of tea essential oil are due to the presence of substances other than those in common. The formation of aromatic substances which provide the characteristic taste and flavour to black tea is due mainly to the action of the enzyme, phenolase. Amino acids are also presumed to play an important role in producing the aroma of tea.

K.L.R.

GENERAL

Cation-exchange resin from commercial cashewnut shell liquid, by Krishnaswamy, N., *Res. & Ind.*, 1960, 5 (5), 127.—Cashewnut shell liquid (CNSL), of which 6000-8000 tons are produced annually in India, has been investigated as a possible raw material for production of a synthetic cation-exchange resin for use in the treatment of water required for boilers, air conditioning units, ice plants, textile industries, etc. At present, Carbion (a sulphonated coal product) is the only base-exchange material produced indigenously.

The CNSL resin developed at the Laboratory is of the phenol sulphonic acid type and, as pilot plant work has shown, it can be manufactured at a cost comparable to that of foreign resins of similar capacity, the import of which is now restricted.

K.L.R.

PART III (Foreign)

ANALYTICAL

Methods of analysis of soluble carbohydrates and pectic substances of citrus fruits, by Sinclair, W. B. and Joffiffe, V. A., *Food Res.*, 1960, 25 (1), 148.—Methods are described for the separation and

analysis of the carbohydrate fractions of the peel, pulp, and juice of citrus fruits. Citrus peel was the test material used in these experiments, but the principles and methods are equally applicable to the pulp, vesicles, and juice.

After extraction of the tissues with 80 per cent ethyl alcohol, the carbohydrates were separated into alcohol-soluble and alcohol-insoluble fractions. A diagram is given for the separation and analysis of the non-volatile organic acids and the

soluble mono- and disaccharides (glucose, fructose and sucrose) from the other constituents of the alcohol-soluble fraction. The amino acids are in this fraction and they also can be quantitatively determined by column and paper chromatography.

A diagram is given for the separation and analysis of the alcohol-insoluble solids, with special reference to the fractionation of the pectic substances of citrus peel. The alcohol-insoluble solids contain the proteins, pectic substances and other high molecular-weight compounds. The water-soluble materials were extracted from the alcohol-insoluble solids, and from this extract the water-soluble pectic substances were subsequently determined on aliquot samples by the carbazole colorimetric method, total uronide CO_2 and the calcium pectate methods. The protopectin and pectate or acid-soluble pectic substances are extracted with dilute hydrochloric acid solution from the water-insoluble residue of the alcohol-insoluble solids, and the analyses for pectic substances are made by the methods described for the water-soluble fraction.

Experimental data presented show carbon dioxide and methoxyl contents in relation to the anhydrogalacturonic acid of the alcohol-insoluble solids of citrus fruit tissues, and certain analytical data are presented on the alcohol-insoluble and alcohol-soluble fractions of Valencia and Navel orange peels.

Vanilla extract II. Stability of lead test solution, by Considine W. J. and Pearl B., *Food Technol.*, 1960, 14 (4), 204.—The A.O.A.C. method for the estimation of the lead number of vanilla extracts involves a blank determination. This is burdensome when large number of determinations are made. To obviate this difficulty, the authors have studied the extent of stability of the test solution with respect to the lead concentration. The test solution has been analysed for lead concentration using an ethylenediaminetetraacetic acid (EDTA) titra-

tion method. The freshly prepared solution had a lead concentration of 0.229 g./100 ml. and after 10 days' storage in amber glass or transparent glass bottle, the value remained the same. The results show that the lead test solution can be stored for at least one week without any significant change in its stability so that the need for blank determination every now and then is eliminated.

K.L.R.

A rapid method for determining alpha-amylase activity, by Sven Hagberg, *Cereal Chem.*, 1960, 37 (2), 218.—A simple and rapid method for determination of amylase activity of flour and pulverized grain is described. The test may be completed in one or two minutes, depending on the amount of alpha-amylase present.

The principle of the method depends on heating a flour-water suspension of 5 g. flour in 25 ml. water very rapidly to determine the time required to gelatinize and, subsequently, to liquefy the flour suspension. For practical purposes the 'liquefaction time' is usually sufficient for evaluating the diastatic properties. However, from the 'liquefaction time' and the 'gelatinization time', both of which may be determined in the same test, the 'diastatic number' may be computed. The 'diastatic numbers' for different flours are related linearly to the alpha-amylase activity over a broad range.

BIOCHEMISTRY AND NUTRITION

Effects of diffused light and darkness on the B-vitamin contents of germinating pulses, by Nandi, D. L., *Food Res.*, 1960, 25 (1), 88.—Thiamine, riboflavin, nicotinic acid, pantothenic acid and folic acid contents of four varieties of common Indian pulses were estimated before and during germination up to a period of 120 hours in diffused light and darkness. The first three vitamins were estimated by fluorometric and chemical

methods and the last two microbiologically. Thiamine, riboflavin, nicotinic acid increased both in diffused light and darkness in all the cases with the progress of germination; the thiamine content, however, decreased after 48-hour germination in *Vigna catiung* and *Cicer arietinum*. The values of nicotinic acid in *Phaseolus mungo*, *Lens esculenta* and *Vigna catiung* were higher in darkness during the later period of germination. Pantothenic acid increased considerably both in diffused light and darkness in *Phaseolus mungo* only and its value was higher in darkness during 96-120 hours. Folic acid decreased greatly with germination, but with *Phaseolus mungo* the vitamin after a fall attained the original value. The folic acid contents fell off sharply in *Phaseolus mungo* and *Lens esculenta* towards the end of germination in darkness.

Composition of some South Pacific foods, by Peters, F. E., Tomono, M. and Wills, P. A., *Food Res.*, 1960, 25 (2), 211.—South Pacific region has complex nutritional problems, which differ widely within the area. Earlier attempts to determine the composition of local foods were only exploratory. The present paper deals with the analysis of 62 different foodstuffs belonging the broad category of roots, tubers and other starchy foods, fruits, nuts, leaves, saps and juices, and others such as pea, dried fish, a type of fungus, rice and bean. Results are presented for the proximate composition of the 62 foods of which 38 foods have also been analysed for vitamins, viz., carotene, thiamine, niacin and ascorbic acid. Amino acid composition of two staple foods of the region, namely, taro and yam (white and red varieties) is reported.

K.L.R.

Improvement of protein value for human nutrition with special reference to supplementation with lysine, by Wrenshall, C. L., *Food Technol.*, 1960, 14 (4), 4.—Protein malnutrition varies from

frank deficiency through debilitating insufficiency to sub-optimal intake. There may well be many persons with a sub-optimal intake even in well-nourished countries like the U.S.—especially groups under nutritional stress as in growth, pregnancy, lactation, convalescence, disease.

One way of providing more protein value to those who need it is to improve the protein quality of some of the poorer proteins they are now eating. An elegant scientific way to do this is to improve their patterns of essential amino acids by adding the limiting amino acid.

Lysine is the limiting amino acid of a number of important foods and in many individual diets. There are four special reasons why lysine is a critical amino acid in human diets.

1. Lysine is absolutely indispensable because the body cannot make it at all.
2. A significant amount of the lysine in foods is nutritionally unavailable.
3. Lysine is lost in food processing and refining.
4. Lysine is readily destroyed or inactivated by cooking.

Arguments objecting to lysine supplementation have been discussed, including mutual supplementation, reasoning from average values, minimum daily requirements and amino acid imbalance.

Lysine supplementation of appropriate foods is proposed as a step toward optimal nutrition.

The influence of soya flour in bread doughs IV. Alpha-amylase of soya, by Learmonth, E. M. and Wood, J. C., *Cereal Chem.*, 1960, 37 (2), 158.—The existence in raw soya of a starch-liquefying enzyme as demonstrated by the amylograph is confirmed. The enzyme is chiefly, if not wholly, a true alpha-amylase. The activity of soya is only of the order of one-hundredth of that of an ordinary wheat malt and it diminishes rapidly with rising temperature and

with falling pH, in contrast with that of wheat malt. These results contradict the findings of some other workers and lead to the conclusion that the alpha-amylase activity of raw soya is not significant in commercial bread-making.

The availability of lysine in wheat, flour, bread and gluten, by Calhoun, W. K., *et al.*, *J. Nutr.*, 1960, 70 (3), 337.—The availability of lysine in wheat, flour, bread and gluten was determined by rat growth studies. Two basal diets, one containing 20 per cent of wheat gluten and the other containing an amino acid mixture (omitting lysine) patterned after this amount of gluten were compared. Performance was measured by gain in weight, gain in empty weight and gain in carcass nitrogen over a three-week period. Response to samples was referred to standard curves and the results were compared with those obtained by microbiological assay. Values of lysine availability were calculated by performance verses percentage of added lysine, performance per 100 grams of food consumed versus percentage of added lysine, and performance versus intake of available lysine. Closest agreement between basal diets resulted when carcass nitrogen gain was related to total available lysine consumed. By this method the availability of lysine in wheat, flour and bread was 75, 72 and 76 per cent respectively, with the gluten basal diet. With the amino acid basal diet, 78, 80, 83 and 80 per cent availabilities were found, respectively, for wheat, flour, bread and gluten.

Evaluation of vitamin B₆ nutrition, by Babcock, M. J., *et al.*, *J. Nutr.*, 1960, 70 (3), 367.—The response of serum glutamic-oxalacetic transaminase to oral administration of vitamin B₆ provides a measure of the state of vitamin B₆ nutrition. This measure is less sensitive than the change in xanthurenic acid excretion (tryptophan load test) after administration of vitamin B₆, but it has advantages

which may favour it in clinical situations.

The vitamin B₆ requirement of young men and women (for maximum serum glutamic-oxalacetic transaminase activity) is greater than 0.5 mg. per person per day.

DEHYDRATION

Oxidation of fat in model systems related to dehydrated foods, by Bishov, S. J., Henick, A. S., and Koch, R. B., *Food Res.*, 1960, 25 (2), 174.—Dehydrated fatty emulsions with an inert matrix of carboxymethyl cellulose were used to evaluate the role of proteins, phospholipids and of iron compounds in lipid oxidations under accelerated storage conditions at elevated temperatures. Phospholipids in concentrations of 0.5 to 5.0 per cent of dry weight of fat protected against oxidation. Protein-containing fat emulsions were more stable than those with oil only and in combination with phospholipids protection was even greater. The catalytic effect of hemoglobin on acceleration of the rate of oxidative reaction resulted in spontaneous combustion within minutes in the dried emulsions stored at 85°C. The oxidative reaction rates in dehydrated systems containing porphyrin compounds were significantly more rapid than in fluid systems when measured by peroxide and thiobarbituric acid values. The pro-oxidant effects of ferric citrate were very small compared to those of porphyrin compounds. Phospholipids alone or in combination with proteins had significant antioxidant action in dehydrated emulsions containing porphyrin compounds, while the phenolic antioxidants, BHT and NDGA, at concentrations of up to 0.03 per cent of dry fat weight, had only slight effects. The data presented in this investigation indicate that such naturally occurring food substances as the phospholipids which appear to have anti-oxigenic properties may find application in attacking the problem of food deterioration caused by fat rancidity.

FUMIGATION

The influence of oil content on the susceptibility of seeds to fumigation with methyl bromide, by Blackith, R. E., and Lubatti, O. F., *J. Sci. Fd. Agric.*, 1960, 11 (5), 253.—Evidence for the greater susceptibility of seeds of higher oil content to methyl bromide is reviewed. Oils increase the sensitivity of seeds to the fumigant at higher moisture contents by making the water more readily available, probably by blocking sorptive substrates. The oil may also act as a reservoir for methyl bromide, so that oily seeds are subject to more severe delays during germination than are less oily seeds. The conditions of moisture content and dosage under which the oily seeds, carrot, rape, cabbage and radish, may be treated, are established, as is the range of oil contents in lucerne, a seed not subject to selection for this character.

OILS AND FATS

Composition of the seed fat of Ceylon sweet, by Weerakoon, A. H., *J. Sci. Fd. Agric.*, 1960, 11 (5), 273.—A study has been made of the composition of the fatty oil which forms about 33 per cent of the dried whole seed. The principal component fatty acids are palmitic (21.8 per cent wt.), oleic (27.4 per cent) and linoleic (34.2 per cent). Myristic and stearic acids each form about 6-7 per cent and linolenic about 2 per cent of the total fatty acids. Lauric and arachidic acids occur in traces. The fat consists chiefly of monosaturated-diunsaturated (54 per cent) and disaturated-monounsaturated (22 per cent) glycerides. Triunsaturated glycerides form about 18 per cent of the fat and fully saturated glycerides about 6 per cent. The fat conforms to 'even distribution' except for the presence of the small percentage of fully saturated glycerides.

PROCESSING

Pilot-plant studies on the continuous batter process to recover gluten from wheat flour, by Anderson, R.A., *et al.*, *Cereal Chem.*, 1960, 37 (2), 180.—Certain variables involved in carrying out the continuous batter process for separating gluten and starch from wheat flour, such as water-to-flour ratio, retention time, temperature of mixing water, and mixer speed, were studied to determine their effect on gluten protein recovery and gluten purity. Generally, the recovery was increased by increasing the mixing-water temperature and by

thickening the batter. However, the purity of the gluten product increased as the batter became thinner. Processing also appeared to be effected by ash content of the flour. As the ash content increased, less gluten was recovered, and the gluten also contained less protein.

Cost estimates for processing 200,000 lb. of flour daily to mill-starch (crude starch slurry) and to wet gluten fractions indicate a plant investment cost of \$316,100 and a processing cost of 26.5 cents per 100 lb. of flour processed.

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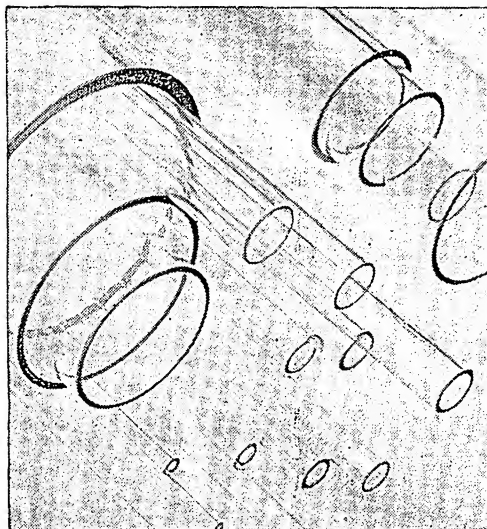
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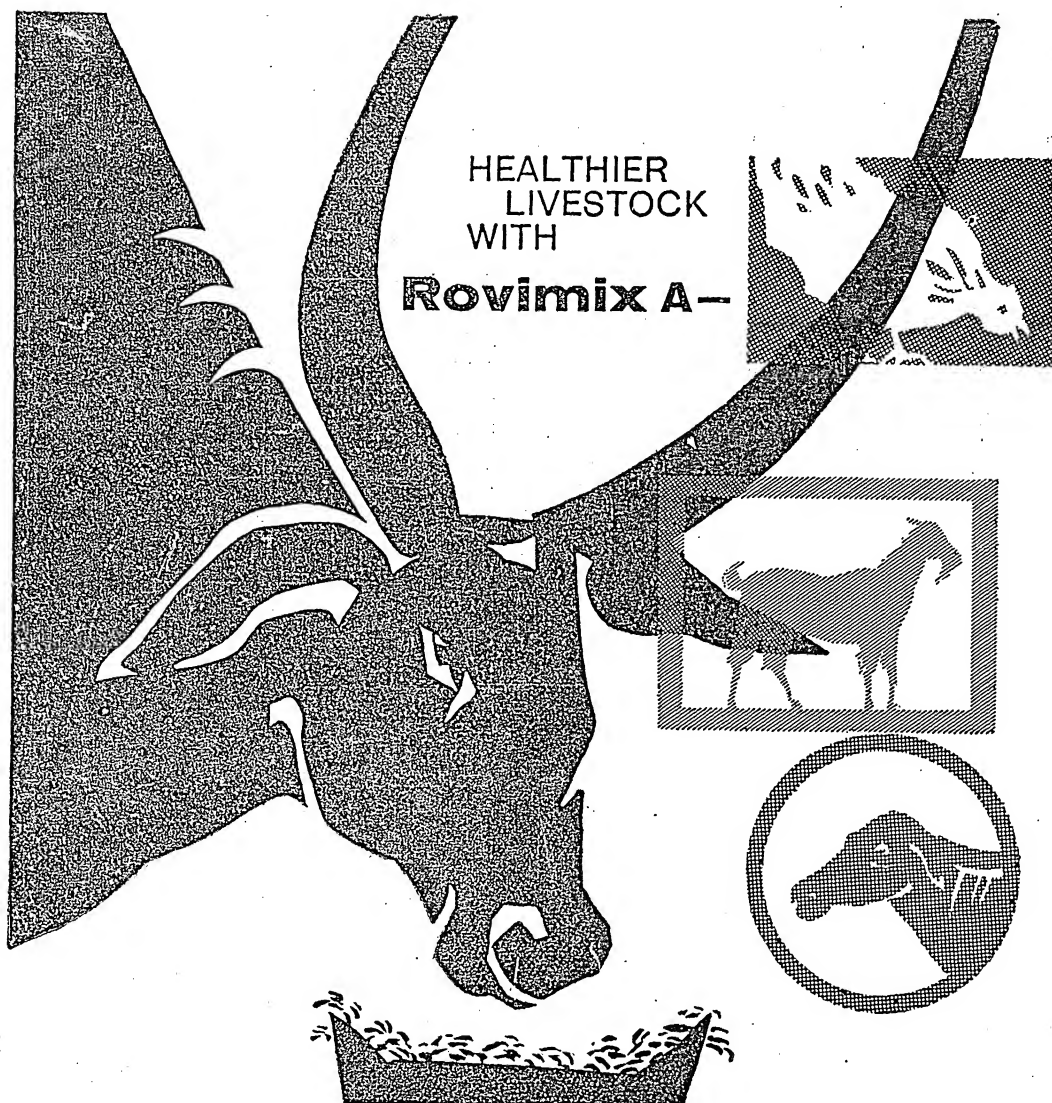
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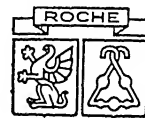


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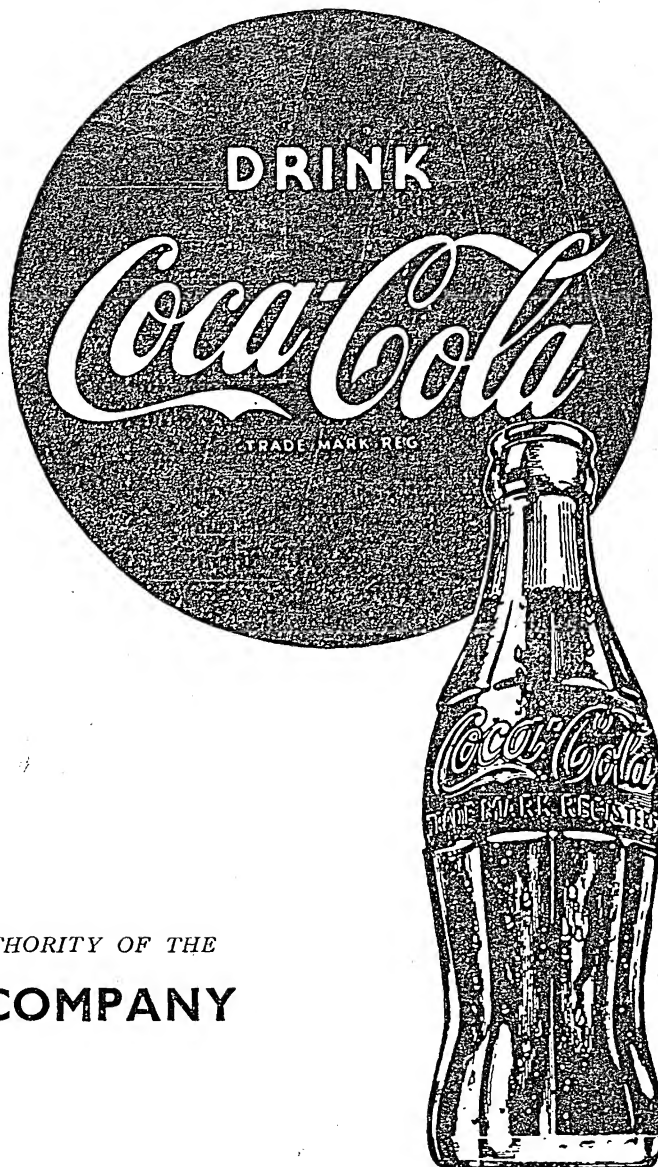
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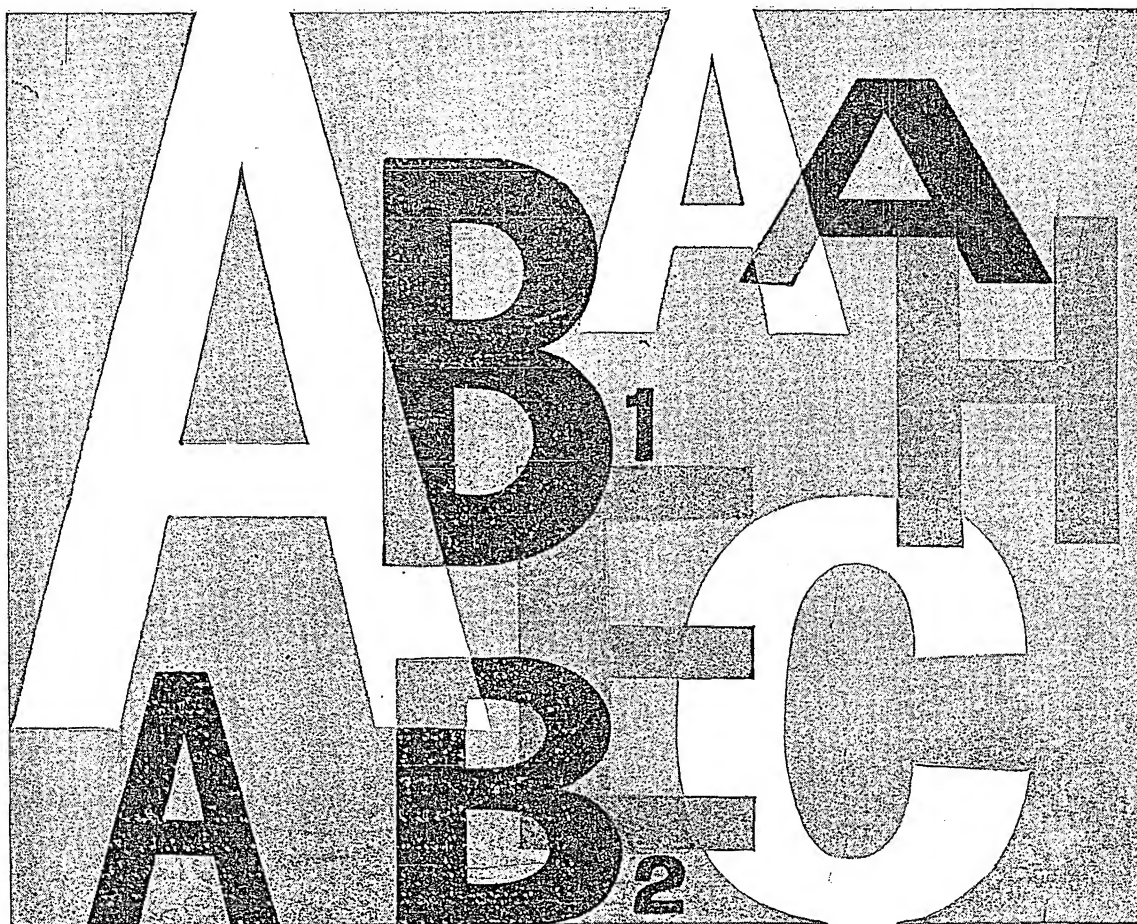
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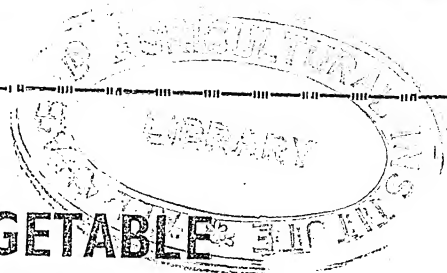
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FRUIT AND VEGETABLE PRESERVATION INDUSTRY IN INDIA

(pp. xiv + 485)

This publication embodies the Proceedings of a Symposium held at the Central Food Technological Research Institute, Mysore, under the Presidentship of Late Dr S. S. Bhatnagar. More than 100 delegates from all parts of the country representing horticulturists, fruit and vegetable products manufacturers (both indigenous and modern), and allied industries like *Machinery, Additives, Packaging*, etc., participated in it.

The volume is packed with up-to-date technical and statistical data on several aspects of the Industry in more than 65 papers read and presented by scientists, technologists, industrialists, as well as importers and exporters of fruit and vegetable products. Besides, there are some papers which bring out adequately the various stages of development of the Industry in the country and the handicaps with which it is faced today. The inclusion of the discussions which followed each of the papers read, has added to the usefulness of the book. It also contains the Recommendations of the Symposium submitted to the Planning Commission for consideration in respect of schemes to be included in the Second Five-Year Plan, and a comprehensive subject index. The recommendations of the Symposium have already found their weight with the authorities concerned in taking appropriate steps for the systematic development of the Industry.

In short, this book gives an authoritative account of the Status of Fruit and Vegetable Preservation Industry in India, provides technical information on several aspects of the Industry and also outlines its scope for future development.

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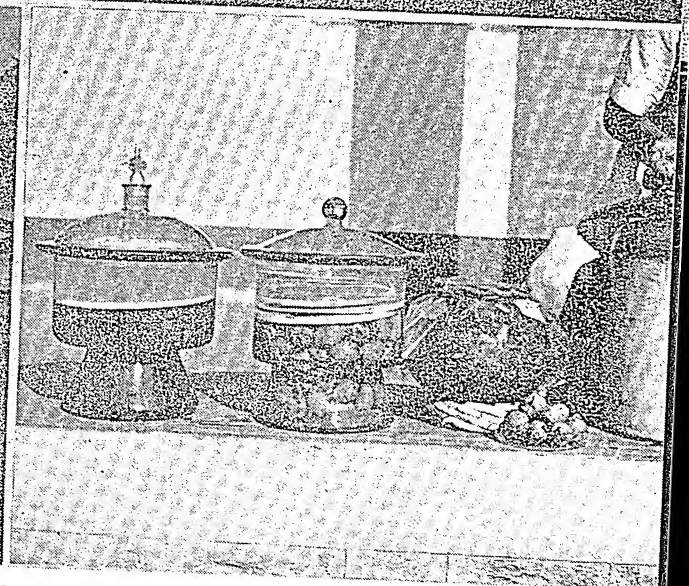
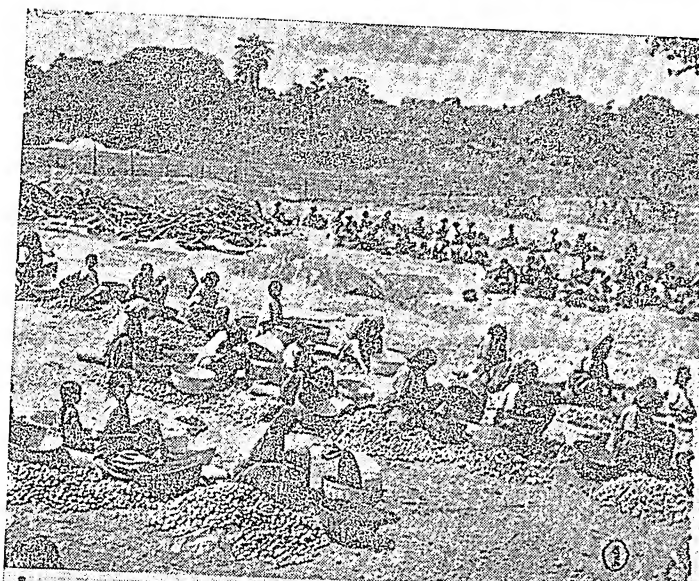
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| 15. Preparation of Jams. | 42. Preparation of Ginger Preserve and Candy. |
| 16. " Mango and other Preserves. | 43. Preparation and Preservation of Pineapple Juice. |
| 17. " Petha Candy. | 44. Canning of Pineapple. |
| 18. " Guava Jelly. | 45. Preparation and Preservation of Pineapple Jam. |
| 19. " Orange Marmalade. | 46. Canning of Sapota Segments. |
| 20. " Sweet Mango Chutney. | 47. Preparation and Preservation of Sapota Squash. |
| 21. " Guava Cheese. | 48. Preparation and Preservation of Sapota Jam. |
| 22. " Tomato Ketchup. | 49. Preparation and Preservation of Loquat Jam. |
| 23. " Mango Leather. | 50. Preparation and Preservation of Loquat Jelly. |
| 24. " Sweet Turnip Pickle. | 51. Preparation of Canned Loquats. |
| 25. " Mango Pickle in Oil. | 52. Dehydration of Ripe Bananas. |
| 26. " Lime and Green Chilli Pickle. | 53. Canning of Ripe Bananas. |
| 27. " and Preservation of Spiced Carrot Juice. | 54. Canning and Bottling of Processed Peas. |
| | 55. Preparation and Preservation of Almond Syrup. |

Indian Sweets Series

1. Preparation and Preservation of *Shrikhand Wadi*.
2. Preparation and Preservation of *Besan Wadi*.
3. Preparation and Preservation of *Rossogolla*.

Substitute Food Series

- | | |
|----------------------------------|---|
| 1. Preparation of Soyabean Milk. | 5. Preparation of Bamboo Chutney (Sweet). |
| 2. " Synthetic Grains. | 6. Canning of Bamboo Shoots in Syrup. |
| 3. " Groundnut Milk. | 7. " " " " " Brine. |
| 4. " Bamboo Candy. | 8. " " " " " Curried Vegetables. |

For further particulars write to the Division of Information and Statistics, Central Food Technological Research Institute, Mysore

STUDIES ON THE NUTRITIVE VALUE OF A BLEND OF WHOLE WHEAT FLOUR, TAPIOCA FLOUR AND LOW-FAT GROUNDNUT FLOUR (Paushtik Atta)

By V. SUBRAHMANYAN, KANTHA JOSEPH, M. NARAYANA RAO, R. RAJAGOPALAN,
D. S. BHATIA, A. N. SANKARAN AND M. SWAMINATHAN

(Central Food Technological Research Institute, Mysore)

The overall nutritive value of a blend of whole wheat flour (75 parts), low fat groundnut flour (8 parts) and tapioca flour (17 parts), known as paushtik atta, has been studied using albino rats. Complete replacement of whole wheat flour by paushtik atta in Indian diet causes a significant improvement in the overall nutritive value of the diet. Fortification of paushtik atta with calcium and riboflavin causes a further improvement in its overall nutritive value. The protein efficiency ratio of the proteins of paushtik atta (1.20 and 0.98) in periods of 4 and 8 weeks respectively is significantly higher than that of the proteins of whole wheat flour (0.94 and 0.82).

India has to import annually 3-4 million tons of wheat to make up the deficit of cereals¹. The situation necessitates a search for alternate sources of foodstuffs for overcoming the cereal shortage. Subrahmanyam and co-workers²⁻⁵ have shown that a blend of tapioca and groundnut flours could be used as a partial substitute for cereal flours. Consumer trials conducted in Uttar Pradesh and Himachal Pradesh have indicated that a blend of whole wheat flour (75 parts), tapioca flour (17 parts) and groundnut flour (8 parts), known as *paushtik atta*, is as acceptable as whole wheat flour to a majority of consumers. The present paper deals with studies on the

nutritive value of *paushtik atta*. In view of the deficiency of calcium and riboflavin⁶ in Indian diets, the effect of fortification of *paushtik atta* with calcium and riboflavin on its nutritive value was also studied.

Experimental

Whole wheat flour (100 per cent extraction) used in the present investigations was prepared by powdering Indian hard wheat free from impurities in a flour mill to pass through a 50 mesh sieve.

Paushtik atta (blended flour) was prepared by blending 75 parts of whole wheat flour, 17 parts of tapioca flour and 8 parts of specially prepared low fat groundnut flour. Tapioca and low fat groundnut flours used in the preparation of *paushtik atta* were prepared according to the method of Subrahmanyam *et al.*⁷

Fortified paushtik atta was prepared by fortifying the blended flour with riboflavin (0.1 mg per 100g.) and calcium carbonate (156 mg. per 100g.)

Samples of whole wheat flour and *paushtik atta* were analysed for their proximate principles, calcium and phosphorus according to the methods of A.O.A.C.⁸ Iron and thiamine were estimated by the methods of Farrar⁹ and Swaminathan¹⁰ respectively. Riboflavin was determined by the method of the American Association of Vitamin Chemists¹¹. Phytate phosphorus was determined by the method of McCance and Widdowson¹². The results are given in Table I.

The essential amino acid composition of the samples of whole wheat flour and *paushtik atta*

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TABLE I. Chemical composition of whole wheat flour and paushtik atta* (Values per 100 g.)

	Whole wheat flour	Paushtik atta*
Moisture (g)	10.1	9.7
Protein (N \times 6.25) (g)	12.1	13.4
Fat (Ether extractives) (g)	1.7	2.0
Carbohydrate (By diff.) (g)	73.4	71.8
Ash (g)	1.5	1.8
Crude fibre (g)	1.2	1.3
Calcium (g)	0.051	0.054
Phosphorus (g)	0.320	0.293
Phytin phosphorus (g)	0.213	0.181
Iron (mg.)	5.3	5.0
Thiamine (mg.)	0.54	0.50
Riboflavin (mg.)	0.12	0.13
Nicotinic acid (mg.)	5.0	5.6

* Blend of whole wheat flour (75 parts), low fat ground-nut flour (8 parts) and tapioca flour (17 parts).

used in the present investigation was determined according to the following methods. Methionine was estimated by the method of Horn *et al.*¹³, tryptophan according to Spies¹⁴ and histidine by the method of Macpherson¹⁵. The other essential amino acids were determined according to the paper chromatographic technique of Krishna Murthy and Swaminathan¹⁶. The results are given in Table II.

TABLE II. Essential amino acid composition of the proteins of whole wheat flour and paushtik atta* (Calculated to 16g. of nitrogen)

Amino acid	Whole wheat flour	Paushtik atta*
Arginine	4.4	6.6
Histidine	2.2	2.2
Lysine	2.2	2.8
Tryptophan	1.1	1.1
Phenylalanine	5.0	5.2
Methionine	2.7	2.2
Threonine	3.5	3.0
Leucine	6.8	6.9
Iso-leucine	3.8	4.0
Valine	4.2	4.3

* Blend of whole wheat flour (75 parts) low fat ground-nut flour (8 parts) and tapioca flour (17 parts).

Nutritive value of poor vegetarian diets based on whole wheat flour, paushtik atta and fortified paushtik atta: The overall nutritive value of poor Indian diets based on whole wheat flour, paushtik atta and fortified paushtik atta was studied by the rat growth method. The composition of the control Indian wheat diet was the same as that described by Subrahmanyam *et al.*². The experimental diets contained paushtik atta and fortified paushtik atta respectively in place of whole wheat flour. Forty two weanling albino rats weighing between 40-45 g. were distributed equally according to sex, litter and body weight and were allotted to three groups. The methods adopted for the preparation of the diets and the feeding of the animals were the same as those described earlier². The diets were cooked with three times the weight of water and were fed *ad lib* to the rats. Records of the daily food intake and weekly increase in body weight were maintained. The feeding was continued for a period of 8 weeks. The average weekly increase in body weight and daily food intake of rats fed on the different diets are given in Table III.

TABLE III. Average weekly increase in body weight of young rats† on wheat and paushtik atta diets (Duration of experiment: 8 weeks)

Diet	Average initial body wt. (g)	Protein content of diet (on moisture free basis) %	Average daily food intake (on moisture free basis) (g)	Average weekly gain in body weight (g)
A. Whole wheat flour	44.6	13.1	9.4	8.3
B. Paushtik atta ...	45.0	14.4	9.5	9.6
C. Fortified paushtik atta ...	44.9	14.4	9.3	10.1

Test of significance of gain in weights:

A~B Sig. at 0.1% level

A~C " " 0.1% level

B~C " " 5% level

† Each group contained 7 male and 7 female rats.

Nutritive value of the proteins of whole wheat flour and paushtik atta: The protein efficiency ratio of the proteins of whole wheat flour and

paushtik atta (at 10 per cent protein level) was determined by the rat growth method of Osborne, Mendel and Ferry¹⁷. Two groups of rats (22 in each group equally distributed with respect to sex, litter and body weight) were fed for a period of 8 weeks on synthetic diets in which whole wheat flour and *paushtik atta* were the only source of proteins. Data regarding the protein efficiency ratio of the proteins of whole wheat flour and *paushtik atta* calculated for periods of 4 and 8 weeks respectively are given in Table IV.

TABLE IV. Protein efficiency ratio of the proteins of whole wheat flour and *paushtik atta* (At approx. 10% level of protein intake)

Diet	Average initial body weight† (g)	Average protein intake (g)		Protein efficiency ratio	
		4 weeks	8 weeks	4 weeks	8 weeks
Whole wheat flour	43.8	18.3	43.1	0.94	0.82
<i>Paushtik atta</i> ...	43.8	18.1	42.7	1.20	0.98
				± 0.06 (19 d.f.)	± 0.03 (19 d.f.)

Test of significance: A~B Sig. at 1% level Sig. at 0.1% level.

† Each group contained 11 male and 11 female rats.

Results and Discussion

It will be seen from the results presented in Table I that *paushtik atta* obtained by blending whole wheat flour with low fat groundnut flour and tapioca flour contained slightly more protein (13.4 per cent) than whole wheat flour (12.1 per cent). It is evident from Table II that whole wheat flour is a good source of all the essential amino acids except lysine. Addition of low fat groundnut flour and tapioca flour to whole wheat flour resulted in an appreciable increase in the lysine content of the blend. The methionine content of the blend was however, slightly less than that of whole wheat flour. The results presented in Table III show that the diet based on *paushtik atta* promoted slightly better growth in rats than the diet based on whole wheat flour. This may be due to the

higher protein content of *paushtik atta*. Fortification of *paushtik atta* with calcium and riboflavin caused a further increase in its overall growth promoting value. The protein efficiency ratio of the proteins of *paushtik atta* was found to be significantly higher than that of whole wheat flour. This may be due to the higher lysine content of the blend as compared with whole wheat flour.

The results obtained in the present study have clearly shown that the nutritive value of *paushtik atta* is significantly higher than that of whole wheat flour. Large scale production and distribution of *paushtik atta* will result in extending the wheat supplies by 25 per cent. Studies on the effect of replacing wheat in the diet by *paushtik atta* on the growth and health of children are in progress.

Acknowledgment

We are thankful to Miss K. Indiramma and Mr N. Nataraja for help in the statistical analysis of results.

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ASCORBIC ACID CONCENTRATE FROM AMLA (*Phyllanthus emblica* Linn.)*

The Indian gooseberry (*Phyllanthus emblica*, Linn.), first reported by Damodaran and Srinivasan¹ as a rich and cheap source of vitamin C, has been the subject of many investigations^{2, 3, 4} for preparing a vitamin concentrate. This note describes another such attempt.

Fresh, big sized fruits from the local market were stored at 0°C. Fruits drawn from this stock were cut segmentwise, pulped in a comminuting mill and pressed out through mull cloth in an all-wooden basket press avoiding contact with heavy metals.

Ascorbic acid was estimated by titration against 2:6 dichlorophenol-indophenol.

Yield of ascorbic acid: The fruits yield 46 per cent (v/w) of juice which contains 55 per cent of the vitamin present in the pulp. A recovery of nearly 80 per cent of the vitamin is obtained by extracting the residual pulp twice with water (1½ L water/residue got from 10 lb. fresh pulp).

Optical rotation of the juice: The juice has $[\alpha]_D^{25} = 18.3^\circ$ based on 10 per cent total solids. This rotation decreases on treatment with calcium carbonate, aluminium hydroxide or baryta and zinc sulphate and is completely lost on treatment with active carbon. The constituents responsible for the laevorotation are yet to be studied.

Keeping quality of the juice: Data on keeping quality of the juice using benzoic acid and sulphur dioxide at 2,000 p.p.m. as preservatives are presented in Table I.

TABLE I. Effect of storage on ascorbic acid in amla juice
(Temp. of storage: 5°C; Ascorbic acid in fresh juice: 5.3 mg/ml.)

Storage period in weeks	Loss of ascorbic acid as per cent of original value		
	Juice (control)	Juice + benzoic acid	Juice + sulphur dioxide*
2	1.0	13.2	7.0
4	6.4	42.4	9.5
6	23.0	64.8	12.0

* Ascorbic acid was estimated after adding acetone according to Mapson⁵.

It will be seen that sulphur dioxide is a better preservative than benzoic acid. The untreated juice retains ascorbic acid better in the first 4-5 weeks although it had fermented. Williams and Corran⁶ had earlier observed that 'lemon juice which contained no added preservative retained its antiscorbutic potency to a great extent and that substances which exert the strongest preservative effect against gross fermentation possess the greatest destructive action on vitamin C'.

Preparation of concentrate: For removing the non-specific matter from the juice, alcohol precipitation, starch, gelatin, calcium chloride, ammonia and neutral lead acetate treatments were tried either singly or in combination. Of the methods tried, treatment with neutral lead acetate followed by two alcohol extractions resulted in a residue containing the highest amount of ascorbic acid per unit weight of the residue, and this procedure is described in greater detail.

Preliminary trials indicated the amount of a 25 per cent (with respect to lead acetate) alcoholic solution of neutral lead acetate required for partial precipitation of tannins. The precipitate was removed by filtration or centrifugation, the filtrate acidified to pH 4 by adding glacial acetic acid and was concentrated to a small volume on a water bath. This concentrate was subsequently twice extracted with alcohol, the residue weighed and the ascorbic acid estimated. It was found that a final residue containing about 250 mg of ascorbic acid per gram could be obtained. The loss of ascorbic acid up to the final stage amounted to about 25-30 per cent and the final residue was free from lead as tested by potassium iodide. This ratio of ascorbic acid to solids in the residue was got by using a partially auto-fermented juice (containing 4 per cent solids). However, when fresh juice (containing 10 per cent solids) was subjected to lead acetate treatment as before, the residue contained only 140 mg. per gram. This value could not be further increased by modifying the treatment.

Paper chromatography of the juice according to the method of Sastry *et al.*⁷ indicated that whereas fresh juice gives 13 bands for polyphenols, the partially fermented juice gives only 3 bands.

* This is part of the subject matter of the thesis for the award of the Associateship of the C.F.T.R.I.

The difference between fresh juice and the partially fermented juice towards lead acetate treatment may be partly due to this difference in the polyphenol make up.

The authors are thankful to Dr M. Srinivasan and Sri M. V. L. Rao for helpful suggestions.

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PROXIMATE AND MINERAL COMPOSITION OF SOME DEEP FAT FRIED VEGETABLES

Nutritive value of a product is an important factor in evaluating its over-all consumer acceptability. In the course of an investigation on the deep fat frying of some vegetables, proximate and mineral composition of fried field beans (*Dolichos lab lab*), lima beans, broad beans, peas and raw banana (plantain) chips was determined by A.O.A.C. methods. A comparative study of the chemical composition of dehydrated and deep fat fried peas prepared from the same batch of peas was also made.

The vegetables were fried in hydrogenated groundnut oil heated to 190°C in an ordinary stainless steel shallow pan, using bunsen burners as source of heat. The frying time was 5 minutes. The take out temperature was 175°C in case of field beans, lima beans, broad beans and peas; and 170°C in the case of plantain slices of 3/32 inch thickness. The ratio of fat to material was kept as 5:1. In the case of field beans, lima beans and broad beans, cuticle was removed by blanching in boiling 1 per cent sodium bicarbonate solution for 4 minutes. Peas were fried and dehydrated after blanching in boiling solution of 0.1 per cent NaHCO₃ and 0.2 per cent potassium metabisulphite for 5 minutes. Plantain skin was removed after steaming for 3 minutes. Dehydration was done in a cross flow cabinet drier at 85°C for ½ hour, 80°C for ½ hour, 75°C for 2 hours and 65°C for 4 hours.

The data on proximate and mineral composition of fried products given in Table I show that these

TABLE I. *Proximate and mineral composition of the fried products*

	Field beans	Lima beans	Broad beans	Peas	Banana (Plantain chips)
Moisture, % ...	3.60	4.20	4.00	4.50	4.00
Ash, % (N × 6.25), ...	1.82	2.56	3.11	1.98	1.43
Protein, % ...	20.80	20.74	18.84	21.05	7.45
Crude fibre, % ...	1.81	2.13	2.21	3.24	0.94
Ether extract, % (by diff.) ...	15.00	16.30	28.30	22.50	43.70
Carbohydrates, % ...	56.97	54.07	43.54	46.73	42.48
Calcium, mg. % ...	54.2	32.5	65.0	26.0	27.0
Iron, mg. % ...	7.5	5.1	3.7	4.1	9.1
Phosphorus, mg. % ...	563.5	1016.0	528.8	397.9	54.9

TABLE II. *Chemical composition of dehydrated and deep fat fried peas*

Per cent	Fresh	Dehydrated	Fried
Moisture ...	66.80	9.50	4.50
<i>Constituents on moisture free basis</i>			
Protein (N × 6.25) ...	18.88	18.94*	14.52†
Protein soluble in 5 % salt solution (fat free basis) ...	13.31	5.87	0.38
Ether extract ...	0.36	1.02	26.21
Crude fibre ...	5.33	4.91	3.24
Ash ...	2.96	2.32	2.35

* Protein content on moisture & fat free basis is 19.14%

† " " " " " " " " is 19.63%

products are rich in protein and fat and contain fair amount of minerals.

Since deep fat frying may be looked upon as a simpler form of dehydration, it is of interest to compare the nutritive value of dehydrated and deep fat fried products. Data presented in Table II on this aspect in the case of peas show that values for total proteins and minerals are almost similar in both the types of products, while fat content is higher in fried product than in dehydrated peas. The solubility of proteins in 5 per cent salt solution seems to be very much affected by the frying process. It is, however, known that in many legumes the biological value of proteins increases on heating because of destruction of trypsin inhibitors present in them¹⁻³. Most of this lowering of salt solubility of proteins seems to take place at the blanching stage as was found by the determination of salt-soluble proteins before (21.81 per cent) and after (7.69 per cent) blanching in 1 per cent NaHCO_3 solution for 4 minutes in another set of experiments in the case of field beans. As shown in Table II, the loss of salt soluble proteins during dehydration of peas is about 60 per cent. This is roughly the same value as observed during blanching of field beans. Thus, it seems that major part of decrease in salt-solubility of proteins takes place during blanching both in the case of dehydrated and deep fat fried products.

Frying under vacuum at a temperature of about 50°C using unblanched material is likely to improve the salt-solubility of proteins in the fried products. Work on this aspect is in progress.

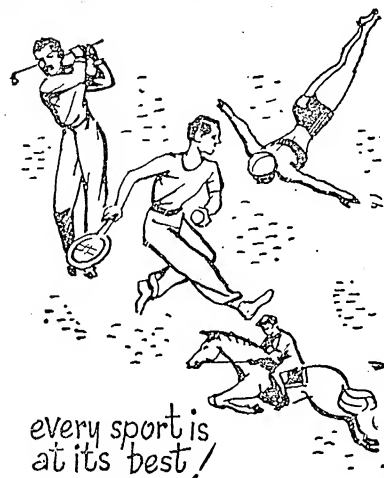
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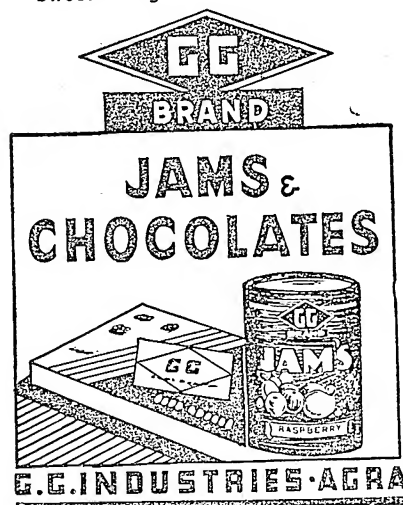
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Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during August 1960 are given in this section.

S (IS) 21

Studies on the preparation of some compounded soup powders, by B. S. Bhatia and K. Gopinathan Nair (*August 4, 1960*).—During the Second World War, necessity to produce quick cooking dehydrated foods led to increased effort in the preparation of soup powders. Even after the War, civilian interest in these products continued, resulting in the development of a highly competitive industry in the Western Countries. In U.K., for instance, the present annual sales of canned soups amount to £25 million and of packet soups to £5 million. According to manufacturers, this consumption represents about 3 platefuls of soup per person in a fortnight and being considered a meagre consumption, there appears to be substantial scope for expanding this industry. In India, with the increasing emphasis on tourist trade and hotel industry and to cater to the needs of sophisticated market, dehydrated soups are likely to be in great demand.

In continuation of the earlier work done in this field in the Institute, further work was undertaken on both vegetarian and non-vegetarian types of soup powders. Drying conditions for precooked potatoes, carrots, green peas, dried peas, cabbage, cauliflower, fennugreek, chicken and mutton have been standardized using cross-flow and through-flow driers. Both driers were found to be satisfactory, drying rate being a little faster in the through-flow drier. It was necessary to take precaution to avoid blowing away of light materials like fennugreek during drying in a through-flow drier. After a number of trials on the dehydration of tomatoes by different methods

including split process and vacuum puff drying, a simple procedure of drying 1/4" thick sliced tomatoes using a cabinet drier was found to be satisfactory, and convenient for the preparation of tomato base. Data on drying yields and drying ratios based on calculated and prepared material basis were collected for the above mentioned dried materials. Except in case of chicken and mutton where slightly higher actual drying yield was obtained when compared with calculated yields, in all other cases, the yields on prepared basis were slightly less than calculated yields. All soup bases could be reconstituted in boiling water in 2-3 minutes and when powdered to 50-60 mesh, reconstitution was instantaneous. Recipes for the preparation of tomato, carrot, potato, green peas, dried peas, chicken and mutton soup powders were standardized using individual bases. Recipes for mixed vegetable soup and chicken with mixed vegetables were also worked out. In some cases, fried beans (field beans, lima beans and broad beans) and peas were also used and in these no extra fat was added. In case of mutton also, addition of fat while compounding the soup was not necessary. Addition of 0.125 per cent monosodium glutamate into the reconstituted soups was found to enhance flavour in all soups except tomato soup. The lower pH in case of tomato may be responsible for this.

Data on proximate and mineral composition of soup powders prepared in the laboratory and those obtained from U.K. market were presented. Comparison of results showed that: (i) fat content was generally less in U.K. samples, (ii) in spite of adding hydrolysed protein, wheat flour, soya flour, skim

milk powder, etc., the protein content of market samples were comparatively low in most cases, (iii) cane sugar was found to be added to most of the market soups and (iv) in both laboratory and market samples, sodium chloride formed the major component of ash. All soups were fairly rich in other minerals like calcium, phosphorus and iron. In general, for obvious economic reasons and to cater to the needs of low income groups, the market samples seem to be fairly diluted with starch, sugar, etc.

Studies undertaken on the equilibrium relative humidity of the soup powders showed that the critical points for tomato and carrot soups were 31 and 51 per cent R.H. respectively; in other cases, critical R.H. was 60 per cent. The quality factors considered for the critical R.H. were pastiness, caking, colour and flavour. Thus, due to the hygroscopic nature of tomato and carrots, the packaging requirements will be more stringent than in other cases.

Preliminary observations on storage of soup powders indicated that in order to obtain a reasonable shelf life of about 6 months at 37° C and one year at room temperature, it is necessary to take the following precautions:

(i) Moisture content should not be more than 5 per cent in soup powders. This may be attained by using desiccants like calcium oxide during preliminary storage of soup powders before packing.

(ii) Antioxidants (0.02 per cent B.H.A.+0.01 per cent citric acid on the weight of fat in the soup powder) should be added in case of green pea soup.

(iii) Presence of yeast powder reduces the non-enzymatic brown-

ing during storage in case of carrot and tomato soup powders.

(iv) Addition of ascorbic acid to soup powders should be avoided as otherwise enhanced discolouration during storage may occur.

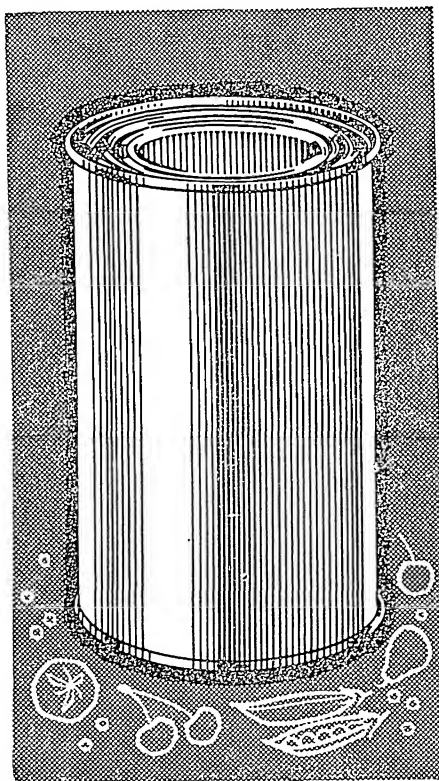
(v) Incorporation of cooked starch into soup powders helps to retain uniform suspension of reconstituted soups during storage.

Some of the important points raised during the discussion were: microbial viability of chicken and mutton soups, need for meat base for using monosodium glutamate, addition of dried yeast resulting in masking of flavour, effect of variety of vegetables on the quality of soup powders, influence of storage on flavour and reconstituting quality, need for developing soup powders based on mushrooms, use of surface active agents and hexametaphosphate to give good reconstitution quality, feasibility of fixing up standards to prevent adulteration,

high fibre in the laboratory samples accounting for poor reconstitution quality, whether slightly roasted urd dhal could not form a good base, basis for calculating the danger limit in determining the critical R.H., whether in-package desiccants need be used, spray-drying of tomato juice, whether finished product would not have taste of SO_2 , possibility of using tapioca flour in place of corn starch and MPF or isolated protein in soup powders, following the new technique of foam-mat drying for tomatoes, high fat content in laboratory samples, etc.

The President in his concluding remarks said that there was a good place for soup powders in our country. There is a case to make several batches of one variety of soup powder and send it to the industry for trial and opinion. All soup powders now available on the market contain meat broth or hydrolysate which makes up for the

nice flavour. Purely vegetable soup powders having all the original flavour can also be made to suit the Indian taste. Although Indians may like more fat in the product, it may lead to certain difficulties in storage and reconstitution. He said that priority should be given for asparagus and mushroom type of soup powders. Even onion soups would be quite popular. We should create some exotic compositions that may attract consumers in our country and even foreigners. Substances which accentuate the flavour and taste like garlic, asafoetida, etc., might also be added in small quantities in the composition. Packaging and storage studies should be thoroughly intensified to get a good flavoured product. He concluded by saying that collaboration of different groups of research workers in the Institute was very necessary in this regard.



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Aiyars

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Extraction of castor oil

E (IS) 69

We have the honour to inform you that we desire to manufacture tasteless and odourless castor oil in our factory using hand oil presses. We shall appreciate if you can favour us with the procedure to be followed. Let us also know whether cold pressed oil is better than the oil extracted by applying heat. (Kakinada).

Castor oil is obtained from the seeds of the castor plant. The kernels which contain over 60 per cent oil are surrounded by a mottled husk which is generally removed before extraction of oil. Usually, the kernels are pressed in the first place at ordinary temperatures when about 30 per cent of a pale oil of great purity is obtained. This oil known as first-pressure castor oil is used in medicine. Since it contains very little free fatty acids it can also be employed as lubricating oil. The cake is then removed and again pressed when about 10 per cent of dark coloured oil (seconds) is obtained. The residue containing 8 per cent of oil can be extracted with solvents and the meal can then be used as manure. The castor beans contain a very poisonous alkaloid (resin) which is found in the hot pressed and extracted oils and also in the cake and therefore, it is never used for food purposes. The expressed oil requires practically no further treatment beyond heating to coagulate the albumens and destroy the activity of the enzyme.

For bleaching of the castor oil, fuller's earth or activated charcoal to the extent of 0.2 per cent approximately is used. The treatment is done under vacuum at a tempe-

perature of 90-110° C. For deodourisation, steam deodourisation under vacuum is a useful method. Higher temperature should be avoided as the castor oil polymerises.

It is the cold pressed, first-pressure castor oil which is desirable for medicinal purposes and not the one extracted by the application of heat.

Hormone treatment of onions

E (IS) 70

I would like to know the details of the method that you have developed for extending the storage life of onions using hormones. Please give the address of the firm supplying the hormone. (Paldhe, E. Khandedesh).

We are glad to note your interest in improving the storage life of onions. From our experience, we have found that if the onion plants are treated 15-18 days before harvest with an aqueous solution of maleic hydrazide containing 600 parts per million of the active component, it would improve the keeping quality of the onions. Bolting should not appear in the plants at the time of this hormone treatment. The onion bulbs can be harvested, cured in the normal way and then stored. The storage life at room temperature will be increased thrice or even four times the normal storage life of the plants without treatment. This chemical is sold in the form of MH_{40} etc., which means that the product contains 40 per cent of the active ingredient. The chemical can be obtained from Messrs. Bombay Chemicals Ltd., 129 Mahatma Gandhi Road, Bombay 1.

Dehydration of dhal

E (IS) 71

We are manufacturing several kinds of dhals such as tur dhal, gram dhal, etc., by the wet method. About 200 bags of the pulse treated by the wet method are put on open ground for drying and it takes 2-3 days for completion. We shall therefore be obliged if you can suggest some quicker mode of drying. (Nagpur).

As regards your desire to go in for a dehydrator for drying of pulses after dehulling by wet treatment, we have to state that since the size of the dehydrator in view is sufficiently big for about 200 bags at a time, it is necessary that facilities for heating either by steam or electricity should be adequate. In the former case, installation of a boiler will be necessary (costing Rs 5,000 approximately) and in the latter case, power at cheap rates should be possible. Besides, an exhaust fan to blow the air in contact with the drying surface will also be required. It is obvious, therefore, that the problem can either be discussed with some local design-engineers and fabricators or a representative deputed to visit this place to have a look at the various types of driers installed here and discuss other aspects of the problem. It may be made clear that this Institute does not undertake to supply the equipment.

Tannins in foodstuffs

E (IS) 72

Will you please enlighten me on the action of tannins in the human system. Kindly throw some light on the portion of the foodstuffs where tannins are concentrated, tannin

content of common foodstuffs and the changes in the tannin content during ripening. How can we remove the tannins without affecting the other nutrients adversely and to what extent are tannins usually metabolised to the human system? (Poona district).

The exact nature of action of tannins in the human system is not clearly known. It is, however, believed that tannins have protein precipitant action and hence cause soothing effect in cases of diarrhoea.

Tannins are generally found in trees and shrubs. They are diffused through the cell sap but they also have a tendency for accumulation in bark, woodstalks, woody tissues and outer parts of fruits. During the course of ripening, the astringency disappears and the tannins are either precipitated or covered up in special cells called tannin sacs.

The tannin content of some of the common foodstuffs are given below:

Roasted coffee	... 3.5-6.0%
Tea (black)	... 7.75-21%
Cocoa (beans)	... 2-5%
Cocoa (shells)	... 10%
Apple juice	... 0.1%
Strawberry	... 0.2-1.0%
Guava seeds	... 1.38%
Apples	... 0.1-0.3%
Banana	... 0.35-1.5% (dry basis)
Sapota	... 0.51% (fresh)
Pomegranate bark	... 13.1% (dry basis)
Myrobalan	... 30.0% (-do-)
Indian gooseberry	... 8.0% (-do-)
Guava (ripe)	... 0.3%
Cashew apple	... 0.16%

The tannin content which is fairly high in certain plant materials at the immature stage goes on decreasing as the fruit or the vegetable ripens on the tree itself.

As regards the removal of tannins, we have to state that they can be leached out with the help of a weak salt solution. This, however, affects other nutrients which are

also leached out into the salt solution.

We have not done much work on assessing the extent of tannins usually metabolised in the human system. Small amounts of tannin normally ingested by human beings are not in any way injurious to health.

Fermentation in the intestines

E (IS) 73

May I know of any substance harmless to the system which, when mixed with one's daily diet, would stop fermentation in the lower bowels and prevent flatulence? (Secunderabad).

We have to inform you that the question of fermentation in the bowels leading to flatulence is not a simple one. The intestinal flora have a large part to play and the type of diet determines the kind of flora. Simple flatulence is easily relieved by taking a few tablets of activated charcoal or carminatives like garlic juice, asafoetida, etc. If it is a persistent condition, a thorough examination has to be made and the cause determined. The cause may be a hypotonic colon or intestinal parasites or sometimes growth. Even constipation may cause flatulence.

Containers for fruit products

E (IS) 74

I would like to know whether polythene containers could be used for filling jams, squashes, vinegar, etc. Please inform me whether vinegar can be protected from harmful microbes using chemicals instead of pasteurization. (S. Kanara).

Acid-proof polythene containers can be used instead of glass jars for packing jams, squashes and vinegar. The cost of these polythene containers will be prohibitive. We have just started some work at this Institute on the packaging of different fruit products in polythene containers and results will be made available as soon as investigations are completed.

After the filtration (or clarification), the vinegar will still contain

acetic bacteria and their spores. When exposed to air, vinegar becomes coated with a film. When vinegar is sent out in barrels and air is allowed to gain access to it, this growth of bacteria grows upon the surface and makes the liquid turbid. The same happens in the case of bottle vinegar when closure is defective and allows air to enter the bottle.

All the species of the acetic bacteria perish at a relatively low temperature, i.e., it is sufficient to heat the vinegar to 150° F. to ensure that it keeps even when exposed to air. The pasteurization has also the effect of acid aroma. It is probable that this is due to its promoting the combination of the residual alcohol in vinegar with acetic acid and thus accelerating the formation of esters to which mature vinegar owes its flavour.

In case, however, you may like to preserve the vinegar without pasteurisation or sterilisation after necessary brewing, filtration and clarification, you may fortify the vinegar with acetic acid—glacial, to total 5 per cent acidity expressed as acetic acid. The acetic acid itself is highly toxic to all the microbes.

Synerysis in jams and jellies

E (IS) 75

We are facing some difficulty in the manufacture of jams and jellies in that synerysis is observed in the resulting products. We shall deeply appreciate to receive your comments on this and the precautions to be taken to prevent the defect. We are sending the samples by post-parcel for your examination. (Bombay).

We have received the post parcel containing one sample each of strawberry jam and raspberry jam packed in glass containers. We find that in the case of strawberry jam, the Brix is only 66°. This bottle was received with a bulged lid and there are appreciable signs of active fermentation in the jam. We suggest that you should keep the Brix of jam, jelly and marmalade at

70-72°. Instead of cooking the jam and jelly to 222-223°F, you can use pocket saccharometers and cook the jam or jelly upto 70° Brix. The Brix of strawberry jam has been found to be 72° and the consistency of the jam is quite all right. There is not much synergism in the jam. In order to prevent the synergism in jam, jelly and marmalade, we suggest to you to observe the following precautions:

(1) As the initial acidity of the pulp that you are using for the manufacture of jam and jelly varies from 0.5 to 1.2 per cent this acidity is quite sufficient to bring about 50 per cent inversion in the sucrose if the cooking period is about 25-30 minutes. Therefore, citric acid, if required, must be added near the end point. This also minimises the hydrolysis of pectin and pre-jelling of the batch.

(2) When the acidity of the pulp is more than 1.0 per cent, please do not add citric acid from outside. In this case, the cooking of the jam

should be as fast as possible. A certain inversion brought about by the cooking process is essential because it increases the solubility of the sugar present and thus avoids crystallisation. Too strong an inversion, however, decreases the solubility again. There are therefore limits for invert sugar within which jam, jelly or marmalade should be kept. 50 per cent of the total sugars in jam, jelly or marmalade as invert sugar is the optimum limit. Jam or jelly containing 70 per cent total sugars can have 35 per cent invert sugars as the maximum limit. The boiling period can thus be limited to half an hour to get good results. Prolonged boiling should be avoided as it also results in loss of flavour, colour and hydrolysis of the pectin.

(3) We feel that the addition of glucose syrup for jam and jelly is not necessary and you can do away with the glucose syrup that you are using in the recipe.

(4) In order to prevent the jam

or jelly from absorbing moisture from the atmosphere because of their hygroscopic nature, seal the jam or jelly with a thick layer of molten hard paraffin wax and then tighten the bottle with the enamelled metallic cap with rubber ring.

(5) Please avoid air bubbles in the jam during filling.

(6) We hope that you are using a slow set pectin for jams and jellies as this allows filling large batches without any pre-setting on cooling before it is filled.

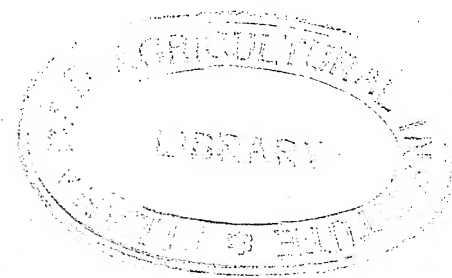
(7) The optimum pH range for jelly formation at 70-75 degrees Brix is 3.4-3.5. To utilise the pectin to the utmost and to ensure the consistent quality of the final product, pH should be closely checked.

(8) If the jam, jelly or marmalade is to be transported to longer distances and subject to rough handling in transit, it must be stiffer than when it has to be stored and sold locally.

Chewer's favourite

**ASOKA SCENTED
BETELNUT POWDER**

Manufacturers: M. K. Krishna Chetty, Post Box No. 106, Coimbatore



Notes and News

NEWS BRIEFS

Insecticidal paints: A new range of insecticidal paints is being marketed in Britain under the name I-Gené. The insecticides are retained in the coating indefinitely, being released on to the surface as a crystalline bloom. This can be temporarily removed or disturbed by severe cleaning, but renews itself on the paint surface within a few hours. On making contact with the bloom, insects are quickly paralyzed and killed.

The new paints are designed to kill most types of insects, such as house flies, ants, earwigs, silverfish, clothes moths, beetles, cockroaches and weevils. The clear lacquer in the range may be used on plain wood work to give protection against wood-worm or termites. Surfaces painted with these coatings are effective for a minimum of two years, even in severe conditions. The paints are non-poisonous to human beings and have no harmful effect on animals (*Food Technol. Austr.*, April 1960, p. 191).

New compound for deep frying: Frytol, a new frying compound which has recently been developed by Edible Oil Industries Proprietary Limited, after a long period of research is causing considerable interest in catering fields. The makers claim that Frytol has many advantages in deep frying relating to the economy of its use and the clean taste of the food it fries.

The product is a pure white shortening designed exclusively for all deep frying work. One most important characteristic of the product is its excellent heat stability which E.O.I. claims reduces fat breakdown and absorption and gives Frytol an extended keeping life.

The product's blandness is another interesting point. Its flavour and odour is insignificant and therefore can have no detrimental influence in the cooking and finished flavour of fried foods.

Another factor relating to the flavour of fried food is the low melting point of Frytol. This technical aspect has a very practical value, in that it allows the excess shortening to drain off the cooked food properly.

In launching this product, E.O.I. has widened the scope of its technical service organization to enable expert technical service for those engaged in deep frying. The service is freely available to anyone desiring advice or practical assistance in matters ranging from trouble shooting to the application of frying mediums and the installation of full scale frying equipment (*Food Technol. Austr.*, April 1960, p. 197).

Foam-mat drying: A new process known as 'foam-mat' drying, has been developed by technologists of the Agricultural Research Service of the U.S. Department of Agriculture and is claimed to convert certain foods into high-quality food powders that can easily be reconstituted even in cold water.

It involves whipping liquid food concentrates into a foam with the assistance of certain additives, spreading the foam on a belt or tray, and compressing and crushing it into powder. So far, powders of good colour and flavour have been made from the juices of tomatoes and fruit; from whole and non-fat milk; and from other liquid foods.

It is claimed that the fine structure of the foam remains stable even when the dried form is compressed into pellets, so that the powders can be readily reconstituted even with iced water. The foam-dried powders have the advantage of holding less moisture at a given relative humidity than spray dried foods, and are, therefore, said to be less liable to cake. According to the research workers, the amount of additive needed is about 1 per cent of the dry solids in the concentrate being whipped. Close control of foam density is obtained by careful adjustment of the quan-

tity of additive and the amount of whipping. Commercial applications are being developed (*Food Manuf.*, April 1960, p. 153).

New multi-purpose plastics containers: New disposable plastics containers, designed for packaging a wide range of food products, are now being manufactured by the Plastics Group of The Metal Box Co. Ltd.

These multi-purpose containers, called 'Polypots' are moulded in Styrol 683 and Styron 440 polystyrene and are tough, heat resistant and will not splinter. They are available in a crystal and a variety of colours, can be overprinted and both the pot and print possess a high surface finish.

The 'Polypots' are ideal for packaging preserves, cheese and sandwich spreads, mincemeats and similar foodstuffs. They have been developed with the ever expanding small pack market in mind, can be automatically filled and capped and greatly enhance a product's sales appeal (*Food Trade Rev.*, April 1960, p. 71).

Volatile flavour components: New molecular essence recovery process is said to produce a full spectrum essence of 500 to 1000 fold in strength, in recovery of volatile flavour components from fruits as they are processed. Recovery units can be installed on existing kettles or vacuum pans for recovery of essences from fruits or purees. Developer will also market concentrated juices or purees for which essences have been recovered both in pressing and processing operations. Concentrates of several fruit juices prepared by the process are available to preservers, extract and flavour manufacturers, ice cream manufacturers, bakery supply houses, and producers of canned and frozen fruit juices. For complete technical information and samples, write to Dept. A & F., Sunshine Packing Corp., North East, Pa. (*J. agric. Fd. Chem.*, March-April, p. 82).

New wheat protein test is reliable as Kjeldahl: A simple, rapid method for determining protein content of wheat and flour, that is said to be as reliable as the Kjeldahl analysis, has been developed by two Agr. Marketing Service Scientists.

Method is based on use of sulfosalicylic acid solution and a colorimeter. Protein is separated from sample and suspended in acid solution, then a photoelectric measurement is made. Through use of equations or prepared tables, colorimeter reading is interpreted in terms of protein content.

Process works well with any pure wheat sample, regardless of where it is grown and under what weather and soil conditions. It is extremely important, however, that sample be ground to uniform particle size (*Food Engng.*, March 1960, p. 113).

Radiation preservation non-toxic: There is no evidence of any toxicity in irradiated foods for either man or animals.

Army radiation preservation reports to Surgeon General support this belief and also state that no ill effects on growth, reproduction, and longevity could be directly traced to irradiated foods.

In addition, although experimental studies show that irradiated beef produced haemorrhages in rats, bleeding is reported caused by effects on vitamin K, suggesting a nutritional rather than toxic effect. Studies noted that addition of vitamin K to radiation-fed rats prevented haemorrhaging.

Also cited are repeated experiments which prove that blindness in rats is no more associated with irradiated than non-irradiated foods and that each is equal in nutritive value.

Other cases of inconsistent and misleading findings are noted in experiments on sterility in dogs and heart defects in mice (*Food Engng.*, March 1960, p. 113).

Liquid shortening—it ups cake quality, cuts costs: Improved texture and extended shelf-life for cakes and yeast-raised

sweet doughs are reported with use of a liquid vegetable shortening newly developed for the baking field.

Key feature of pourable ingredient, Durkee's Fluid Flex, is the 'Micromulsifier (glyceryl lactostearate)' that rapidly disperses in batters to give greater yield and softer texture.

Maker cites cost savings through faster measuring, reduced creaming time, less waste, and elimination of tedious scooping from drums.

Revolutionary product, gaged at 0.92 sp. g., can be pumped, metered, or measured directly into a batch, using any liquid bulk-handling system. And with same stability as a top quality vegetable oil, it can be delivered in drums, tanks or 10-qt. cans.

Repeatedly, its use requires no basic formulation change, although it may be necessary to increase amounts of water or milk for optimum results, depending on nature of other batch ingredients (*Food Engng.*, April 1960, p. 117).

University of Michigan measures effects of caffeine: If you don't get a lift from your daily coffee break, chances are that your 'timing' is off.

That's what the University of Michigan Medical Centre has found in what is believed to be the first experimental evidence to be collected on the effect of caffeine on the isolated cortex of the brain.

They say that the caffeine in one cup of coffee partially blocks the effects of a second cup for a period of about three hours. The scientists call this blockage 'Tachyphylaxis'. University findings indicate that caffeine is a tricky drug which while it stimulates also serves as temporary immunization against further stimulation.

The scientists found that the average cup of American coffee contains 100 milligrams of caffeine. This caffeine content stimulates in about twenty minutes, and continues for a period of approximately 2½ hours at which time the effect ends. Curiously, the researchers found, an additional cup of coffee

taken during the 2½ hour span did not raise the stimulation level as much as the first cup. As an example the findings showed that if you have your breakfast cup of coffee at seven a.m. you will get little 'lift' from a follow-up cup until after ten a.m.

Scientists doing the experimentation on brain stimulants are Dr Edward F. Domino, associate professor of pharmacology and Dr A. K. Maiti, formerly of Calcutta University (*Coff. & Tea Ind.*, July 1960, p. 117).

NEW INDIAN STANDARDS

Cane molasses: Cane molasses is an important by-product in the manufacture of cane sugar. The material is used for the preparation of Hukka tobacco and in the fermentation industries for production of ethyl alcohol, rum, yeast, acetone, butanol, certain organic acids, etc. But its largest use in India at present is in the alcohol industry.

In the Indian Standards Specifications for Cane Molasses (IS: 1162-1958) three grades of molasses with varying requirements have been specified after due consideration of these factors as well as of the existing rules laid down by the states of Uttar Pradesh, Bihar and Bombay for controlling its sale.

Requirements and methods of test prescribed in the draft are in respect of density, sulphated ash, total reducing sugars, etc. Details of sampling, marking and packing are also included.

In view of the ease of determination of total reducing sugars when compared to that of fermentable sugars, and because of the fact that about 95 per cent of the total sugars in molasses are fermentable, requirements for total reducing sugars, as against fermentable sugars, have also been prescribed (*ISI Bull.*, March-April 1960, p. 110).

DRAFT INDIAN STANDARDS

Infant foods: The infant foods at present in use in the country can be divided into three categories:

(a) infant milk foods, (b) processed cereal infant foods, and (c) special infant foods. An Indian Standard Specification for Infant Milk Foods has already been finalized. The remaining categories have now been covered by two draft specifications.

The first draft covers food intended for feeding infants at the weaning stage, either wholly or as a partial substitute for infant milk foods or for mother's milk; second draft deals with foods intended for general feeding of infants and for feeding infants in special cases (*ISI Bull.*, May-June 1960, p. 156).

FOREIGN PATENTS

827,172. Cocoa-butter substitutes: In preparing confectionery products, part of the cocoa-butter which would normally be present, is replaced by a palm oil fraction having an iodine value not exceeding 45, a dilation at 20°C of not less than 1,000 and a softening point between 30° and 45° C.; one of the objects is to find a cheaper fat to substitute for at least part of the cocoa-butter which is added to the ground nib in the manufacture of chocolate.—Patented by Unilever Ltd. (*Food Trade Rev.*, April 1960, p. 88).

828,868. Processing nuts: The flavouring of the kernels of peanuts whilst still in their shells, is effected by providing a differential pressure between the interior and exterior of the shells to permit penetration of the processing fluid which can be in various forms, such as a liquid solution, vapour or gas, and this fluid may produce a salted, sugared or other flavoured effect as desired.—Patented by Kenyon Son and Carven, Ltd. (*Food Trade Rev.*, April 1960, p. 88).

828,350. Alginat jellies: Relates to a powdered product capable of dissolving in cold water and set to a jelly, comprising a water soluble salt of alginic acid, one or more salts whose cations form a

water insoluble salt with alginic acid and which have a solubility product not exceeding 10^{-4} at 25° C, an alkali metal carbonate and an edible solid acidic substance.—Patented by Alginate Industries Ltd. (*Food Trade Rev.*, April 1960, p. 88).

826,554. Margarine: Relates to the treatment of milk, for use in making emulsions of fatty oil and milk which are solidified in the course of margarine manufacture, under conditions facilitating satisfactory bacteriological control over the finished product. The milk is inoculated with a culture producing a desirable flavour; ripened by maintaining the inoculated milk at a temperature suitable for the development of such flavour, and the ripened milk heat treated under conditions adequate to destroy all said culture bacteria in the milk, but not such as to damage the physical condition of the milk or alter the flavour developed by the culture.—Patented by Thomas Hedley and Co., Ltd. (*Food Trade Rev.*, April 1960, p. 88).

826,415. Grading coffee beans: Bernhard Martin Aagaard has invented an apparatus and evolved a related method for grading coffee beans, whereby water consumption and manpower requirements are held to a minimum. The beans are passed through a tank of water with a jiggling movement. The skins are removed and the beans graded into a first-grade heavy fraction, a second-grade fraction of deformed beans and unpulped barries, and a low-quality float material consisting of skins and poor beans. Each grade is carried to a different zone in the tank (*Coff. & Tea Ind.*, July 1960, p. 56).

2,936,528. Coffee roasting: In a coffee bean roasting machine and method which retains more aromatics and reduces roasting losses, Joseph Wilhelm Brandl pre-roasts the beans without pressure, draws off water vapors, continues the roast under pressure, and finally

injects a cooling agent to at least partially cool the beans without a pressure drop (*Coff. & Tea Ind.*, July 1960, p. 56).

2,929,716. Solid water-soluble coffee extracts: In the preparation of a solid water-soluble coffee extract known as 'instant coffee' which will not foam in the cup, William E. Barch and Ismar M. Reich incorporate a small amount of a fatty acid or fatty acid salt in instant coffee of the usual type. The preferred fatty acids are coffee oil or saponification-hydrolysis products thereof, such as oil from roasted or green coffee, or from spent coffee grounds.—Patented by Standard Brands, Inc. (*Coff. & Tea Ind.*, July 1960, p. 56).

2,933,394. Preparation of coffee tablets: In the preparation of coffee tablets that will make a coffee product possessing natural aroma and fragrance, Frank J. Baume first subjects green coffee beans to a hot stream of gases to scorch and blister the beans and remove loosened chaff and skin therefrom. The beans are then sliced or broken into particles, and the particles dried in a hot gas stream. The dried material is ground, compressed into tablets and packaged. The container is evacuated, sealed, heated to 375° F. and cooled.—Patented by Inks Bros. (*Coff. & Tea Ind.*, July 1960, p. 57).

2,927,860. Concentrating a tea extract: In a process for concentrating a tea extract without loss of aromatic ingredients and with recovery of non-aromatic flavour-producing ingredients, Edward Seltzer and Frederick A. Saporito prepare a hot water extract from processed and dried black, green, Oolong or mixed tea leaves. This extract is then continuously evaporated under vacuum at relatively low temperatures, and the resulting condensate concentrated under atmospheric pressure in an aroma fractionating column. Patented by Thomas J. Lipton, Inc. (*Coff. & Tea Ind.*, July 1960, p. 57).

Information from Foreign Journals

THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

GERMAN

DIE INDUSTRIELLE OBST-UND GEMUSEVERWERTUNG

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Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Studies on equilibrium relative humidity (E.R.H.) for onion powder, by Pruthi, J. S. and Girdhari Lal, *Curr. Sci.*, 1960, 29 (1), 19.—The authors have determined the equilibrium relative humidity and the critical point for onion powder during storage. Freshly prepared onion powder was stored in 9 lots at 25-26° C and exposed to relative humidities ranging from 5-90 per cent. The gains or losses in weight of different lots were determined after 1, 2, 4, 8 and 24 hours and followed up every day till the moisture equilibrium at each R.H. was attained. The equilibrium moisture content and the corresponding time in days required to reach it are given. The effect of moisture level on the texture and general condition of the powder has also been studied. The results show that the E.R.H. for a typical onion powder (about 4 per cent moisture) is less than 5 per cent at which level the powder remains in a free-flowing condition. The critical point, as regards caking of the powder is concerned, is found to be at 8.39 per cent moisture level. It was found that visible changes in the colour of onion powder occurred only after 15 per cent moisture level. The present study indicates the need to reduce the moisture in onion powder to 4 per cent or less so that it remains in a free-flowing condition and the colour and flavour changes are minimum.

K.L.R.

Bleaching earths as insecticides, by Majumder, S. K. and Krishnamurthy, K., *J. sci. industr. Res.*, 1960, 19C (1), 29.—Activated clays and earths are used for bleaching of oils. Eight different bleaching earths have been screened for their insecticidal activity. The

materials selected were activated by refluxing them with 1:1 hydrochloric acid for 5 hours. One of the samples used, *vis.*, the ceramic grade Bhageshpura clay was treated with different strengths of the acid for varied periods to obtain different degrees of activation. The insecticidal potencies of the activated and unactivated samples have been assessed using *Tribolium castaneum* adults. The insects starved for 24 hours were exposed to the action of the earths on porcelain plates in enclosed glass rings at 75 per cent R.H. and 26° C for different periods. Percentage mortality of the insects after different exposure periods is given. Bleaching activities of the samples have also been determined using refined groundnut oil. The results show that earths having good bleaching properties possess high insecticidal potency. Acid activation of the materials is found to enhance the insecticidal activity considerably. The insecticidal potency and bleaching action of a clay sample is therefore directly related, although a quantitative relationship has not been deduced in the present study.

K.L.R.

Effect of ammonia exposure to potatoes during refrigerated storage, by Subrahmanyam, H., D'Souza, S. and Srivastava, H. C., *J. sci. industr. Res.*, 1960, 19C (1), 31.—Liquid ammonia is commonly used as refrigerant in cold storages. If there be any mechanical defects, leakage of ammonia occurs, which may injure the commodity stored. In this note, the authors report the nature and extent of damage caused to potatoes when exposed to ammonia vapour during storage. Potatoes were kept on false bottom in desiccators for the control as well as

ammonia exposure tests. Cotton wool soaked in liquor ammonia was placed at the bottom of desiccators for the latter test. The desiccators were immediately sealed and kept at R.T. (68°-74° F and 47-65 per cent R.H.) and at low temperature (35-38° F and 90-92 per cent R.H.). The potato tubers were examined for physical injury and analysed for vitamin C, nitrogen, reducing, non-reducing and total sugar contents before and after treatments, *i.e.*, after 4 days at R.T. and after 8 days in cold storage. The results show that vitamin C retention is better in the control as compared to potatoes exposed to ammonia. No significant difference is observed in the total nitrogen content while the sugars are broken down in the ammonia-treated tubers at both the storage temperatures. All the tubers exposed to ammonia were injured while no wastage was found in controls. The characteristics of the injury caused by ammonia are given. The results of this study conclusively establish the hazardous effects caused by accidental ammonia leakage in cold stores.

K.L.R.

Supplementary value of the proteins of sunflower (*Helianthus annuus*) and sesame seeds to groundnut and Bengal gram (*Cicer arietinum*) proteins, by Tasker, P. K., *et al.*, *Ann. Biochem. expil. Med.*, 1960, 20 (2), 37.—The protein efficiency ratios of the proteins of edible flours from groundnut, sesame and sunflower seed and of Bengal gram and their blends have been determined at 10 per cent level. The proteins of sunflower seed possessed a higher PER than those of groundnut, Bengal gram and sesame. Both se-

same and sunflower seed proteins supplemented to a significant extent those of groundnut, Bengal gram and their blends.

The metabolism of nitrogen, calcium and phosphorus in children on a jowar (*Sorghum vulgare*) diet, by Kurien, P. P., *et al.*, *Ann. Biochem. exptl. Med.*, 1960, 20 (2), 47.—The metabolism of nitrogen, calcium and phosphorus was studied in seven boys aged 10-11 years on a poor jowar diet. The composition of the diet was similar to that consumed by the poorer classes of people of South India. All the experimental subjects maintained a positive nitrogen balance, the average daily intake

and retention being 6.91 g. and 0.88 g. respectively. The excretion of nitrogen in faeces was very high (3.08 g.), the apparent digestibility of the proteins was only 55.4 per cent. The average daily intake and retention of calcium were 0.441 and 0.075 g. respectively. All the subjects maintained positive calcium balance. The average daily intake and retention of phosphorus were 1.09 and 0.31 g. respectively. All the subjects maintained positive phosphorus balance.

Studies on the nutritive value of sesame seeds. Part I. The amino-acid composition of the proteins and the chemical composition of white and black

varieties of sesame seed and meal, by Krishnamurthy, K., *et al.*, *Ann. Biochem. exptl. Med.*, 1960, 20 (3), 73.—The chemical compositions of white and black varieties of sesame seeds (*Sesamum indicum*) (whole and dehusked) and their meals were determined. Dehusking resulted in considerable loss of mineral matter, calcium and oxalic acid present in the whole seeds. Sesame proteins were found to be rich in methionine and tryptophan, and no appreciable difference was observed in the amino-acid composition of the white and black varieties of sesame seeds.

PART II (Indian)

ANALYTICAL

Investigation of amino-acids in the berries of *Withania somnifera* Dunal., by Atal, C. K. and Schwarting, A. E., *Curr. Sci.*, 1960, 29 (1), 22.—The presence of a high proportion of free amino acids in the fruits of *Withania somnifera* Dunal was suspected as a result of a strongly positive colour with ninhydrin. The present report is an attempt to identify the amino acids. Dried berries of *W. somnifera* were macerated with 80 per cent ethanol for one hour and an aliquot of the resulting clear extract was subjected to paper chromatographic analysis using three different solvent systems. The R_f value found and the nature of the colour obtained with ninhydrin have been given for each solvent system and the identity of the amino-acids inferred. The presence of valine, tyrosine, proline, alanine and glycine has been confirmed using known amino-acids for comparison. Fresh berry extract also gave similar spots indicating that these amino-acids are present as such in the plant itself and are not formed by enzymatic hydrolysis during drying. The presence of the proteolytic enzyme, chymase, in the berries may be responsible for the occurrence of

large amounts of the free amino-acids.

K.L.R.

Paper chromatographic separation of silver, lead and mercurous mercury metals, by Mohan Rao, V. K., *J. sci. industr. Res.*, 1960, 19 B (5), 171.—The qualitative separation and identification of lead, silver and mercurous mercury cation mixtures has been reported using simple inorganic solvents, namely 0.2N sulphuric acid and ammonium nitrate-ammonia mixture. A simple chromatographic method has been described for the estimation of lead and silver in a mixture.

BIOCHEMISTRY AND NUTRITION

Some observations on hypoglycemic activity of *Momordica charantia*, by Sharma, V. N., Sogani, R. K. and Arora, R. B., *Indian J. med. Res.*, 1960, 48 (4), 471.—Fruits, leaves and roots of the plant *Momordica charantia*, commonly known as bitter gourd, are used in Ayurveda for a number of diseases including *Diabetes mellitus*. In the present investigation, the hypoglycemic action of the fruit has been studied. Bitter gourd juice ranging from 2-12 c.c.

per kg. was orally given to normal and alloxan induced diabetic animals after 12 hours of fasting. Blood sugar was estimated initially and at intervals of one hour for a period of 5 hours. 2 c.c. and 4 c.c./kg. doses of the juice do not have any significant effect on blood sugar level. 6 c.c./kg. was found to be the optimal dose and with this, the maximum fall in blood sugar level is observed after 2 hours onwards. The blood sugar continues to fall up to 4 hours in diabetic rats and thereafter rises. Glucose tolerance test has also been carried out and the results discussed. Single and double daily doses of 6 c.c./kg. of juice was also tried resulting in a slow and steady fall of blood sugar level both in normal and diabetic animals. It was, however, found that with both the dosages, 80 per cent of normal and 90 per cent of diabetic animals died at different intervals of 5-23 days. Administration of bitter gourd juice two hours prior to giving alloxan did not prevent the diabetogenic action of alloxan. Although the juice has some hypoglycemic activity, it produces certain serious toxic effects and side reactions like uterine haemorrhage in pregnant rabbits, death of majority of the animals in 23 days and sluggish-

ishness within one hour. The authors have expressed the hope that separation of the non-toxic hypoglycemic active principle from the bitter gourd juice would prove it to be useful as oral antidiabetic agent.

K.L.R.

Electrophoretic studies of the serum proteins in protein malnutrition, by Kulkarni, B. S., Satoskar, R. S. and Chitre, R. G., *Indian J. med. Res.*, 1960, 48 (4), 488.—Serum protein fractions in 58 children and 15 adults with protein malnutrition have been studied electrophoretically. There was a decrease of serum total protein, albumin and beta globulin associated with an increase in alpha and gamma globulins. Rise in gamma globulin was more marked in adults. Although the amount of albumin was greatly reduced the amount of total globulins was as high as normals. Albumin, beta globulin and A/G ratio showed a progressive fall with increase in the severity of the disease judged by increase in oedema, anaemia, and fatty liver change. The gamma globulin showed a rise with increase in liver damage. Implications of above findings are discussed.

Effect of different fats on serum cholesterol levels in monkeys, by Gopalan, C., Srikanthia, S. G. and Ramanathan, K. S., *Indian J. med. Res.*, 1960, 48 (4), 495.—The effects of different dietary fats at 25 per cent levels on the serum cholesterol level have been studied in monkeys. Coconut oil and hydrogenated vegetable fat produced a marked increase, while nigerseed oil and corn oil produced a depression in serum cholesterol concentrations. Groundnut oil brought about a relatively moderate rise. The maximal changes were brought about between two and three months after the high fat feeding. Changes in phospholipid levels usually paralleled changes in the serum cholesterol. With continued high fat feeding, changes in the serum cholesterol level were not progressive, but were main-

tained either well above or well below the pre-experimental levels, depending upon the type of fat used, for a period as long as 300 days. The results obtained in this investigation do not conform to the prediction formula of either Keys *et al.* (1957) or of Heasted *et al.* (1957). The changes in serum cholesterol level appeared to be roughly inversely related to the polyunsaturated fatty acid content of the dietary fat. Fats poor in PUFA induced marked elevation of serum cholesterol, while fats rich in PUFA, actually depressed these levels. Supplementation of 5 per cent nigerseed oil to a 25 per cent hydrogenated vegetable fat diet, caused a marked lowering of serum cholesterol levels—more than what could be expected by the increase in PUFA level. Supplementation of vitamin B₁₂ to a high hydrogenated vegetable fat diet did not modify the response. Heating hydrogenated vegetable fat for an hour at 240°C did not influence in any way, its ability to raise serum cholesterol concentration. Estimations of urinary 17-ketosteroids did not reveal any differences between the various groups.

Effects of different dietary fats on the fecal excretion of bile acids, by Srikanthia, S. G. and Gopalan, C., *Indian J. med. Res.*, 1960, 48 (4), 503.—The effect of different dietary fats on the fecal elimination of bile acids has been studied on four normal human volunteers, with simultaneous determination of serum cholesterol level changes.

The feeding of fats rich in polyunsaturated fatty acids, caused a depression in serum cholesterol levels, with a concomitant increase in fecal bile acids, as compared to the fats poor in PUFA, in three of the four subjects investigated. The one subject who showed no alterations in his serum cholesterol levels, with a change in the dietary fat, also showed no alterations in the fecal bile acid excretion.

It is suggested that there exists an inverse relationship between serum cholesterol levels and fecal

bile acid excretion, and that fats rich in PUFA bring down serum cholesterol levels by raising the fecal output of bile acids.

Effect of dietary supplementation on the composition of breast milk, by Belavady, B. and Gopalan, C., *Indian J. med. Res.*, 1960, 48 (4), 518.—The effects of supplementing the mothers' diet with vitamin A, thiamine, ascorbic acid and calcium on the concentration of these constituents in milk have been studied. Supplementation of the mothers' diet with vitamin A had no effect on the concentration of this vitamin in milk. Thiamine and ascorbic acid supplements brought about increase in the concentration of the same in milk. Calcium supplementation for short periods had no effect while longer periods of supplementation reduced the calcium concentration of milk.

Effects of fats used in Indian diets on blood coagulation mechanism, by Gupta, K. K., *et al.*, *Indian J. med. Res.*, 1960, 48 (4), 524.—The effect of milk, ghee, groundnut oil, hydrogenated groundnut oil, mustard oil, sesame oil and coconut oil on blood coagulation of twenty human volunteers has been studied. All the fats produced significant depression of whole blood clotting time and stypven time of dilute plasma. Stypven time of plasma was depressed by all fats excepting mustard oil. Stypven time of citrated blood was not affected significantly by any of the fats. Hydrogenation of groundnut oil has produced no significant change in the effect of groundnut oil on blood coagulation. There is no correlation between the various tests used to test the coagulation mechanism except stypven time of plasma and stypven time of dilute plasma.

DAIRY

Estimation of standards for chemical quality of market milk, by Amble, V. N. and Jacob, T., *Indian J. Dairy Sci.*, 1960, 13 (2), 83.—The paper presents an account of the results obtained

from the statistical analysis of the data on butter-fat content, solids-not-fat content and specific gravity of genuine milk samples from individual cows and buffaloes collected in the States of Bihar, Punjab and West Bengal. Percentage butter-fat was found to be the most variable character and specific gravity the least. Variations among regions and seasons were examined. The tolerance limits calculated were found to vary in different areas and the limits for summer season were, in general, lower than those for the other two seasons. The problem of exact calculation of tolerance limits on the basis of theoretical distributions and their estimation for herd and mixed milk from individual samples needs further investigation.

Physico-chemical properties of cow and buffalo milk. VIII. Electrometric titration of milk, by Sat Prakash and Puri, B. R., *Indian J. Dairy Res.*, 1960, 13 (2), 97. —The electrometric titration curves of a large number of samples of cow and buffalo milk with a dilute solution of sodium hydroxide were determined. The point of inflection in each case was found to lie in the pH range 8.3 to 8.4. The amount of alkali required for the neutralisation was independent of fat and ash contents but varied with protein content of milk. A simple relationship between the two quantities could be worked out. The buffer indices decreased continuously with rise in pH value.

FISH

Studies on the microbial spoilage of canned food. III. Isolation of thermophilic cocci from an imported canned fish, by Rangaswami, G. and Venkatesan, R., *Proc. Indian Aca. Sci.*, 1960, 51 (6), 264. —A spoiled canned fish, imported from Scotland, was examined and the spoilage was found to have been caused by a cocci type of bacterium. The bacterium was brought into pure culture, studied for its morphological, cultural and physiological properties and on the basis

identified as *Streptococcus thermophilus* Orla-Jensen. Its ability to cause spoilage was proved by inoculating it into freshly processed fish cans. The strain was resistant to heat up to 205°F and it failed to grow at 20°C. On its temperature relationships, explanation has been offered for its spoilage under Indian conditions and its inactivity under the conditions obtaining in the country where it was packed.

INSECTICIDES

Studies on indigenous insecticidal plants: Part III—*Acorus calamus* Linn., by Mukerjea, T. D. and Ram Govind, *J. sci. industr. Res.*, 1960, 19C (5), 112. —Ether, petroleum ether and alcoholic extracts of *Acorus calamus* rhizome have been examined for their insecticidal activity (as contact insecticide) and residual toxicity against *Musca nebulo* adults and ovidical and stomach poison effect against *Bombyx mori* eggs and larvae respectively. The ether extract of *A. calamus* has been found to be 17 times less toxic than DDT. As a stomach poison it is toxic to *B. mori* larvae. It also exhibits ovidical activity but has no residual toxicity.

Relative toxicity of insecticidal films to adults of *Trogoderma granarium* Everts., *Oryzaephilus surinamensis* Linn. and *Laemophloeus minutus* Oliv., by Pradhan S. and Sarup, P., *J. sci. industr. Res.*, 1960, 19C (6), 135. —The toxicity of films of nine insecticides (p,p'-DDT, γ-BHC, Aldrin, Dieldrin, Endrin, Isodrin, Toxaphene, Chloridane and Parathion) to adults of three species of Coleoptera has been studied. The relative toxicity of these insecticides was found to be 1.0, 4.4, 0.82, 10.8, 74.1, 0.29, 2.5, 0.93 and 316.1 respectively for *Trogoderma granarium* Everts; 1.0, 0.016, 0.017, 0.42, 0.011, 0.003, 0.15, 0.009 and 3.1 respectively for *Oryzaephilus surinamensis* Linn. and 1.0, 0.55, 0.29, 1.8, 4.8, 0.18, 0.07, 0.12 and 97.8 respectively for *Laemophloeus minutus* Oliv.

OILS AND FATS

Pilot plant studies on the processing of Indian cottonseed—Part II. Effect of cooking conditions on the crushing of American type (Lakshmi) cottonseed, by Thirumala Rao, S. D., *et al.*, *Indian Oilseeds J.*, 1960, 4 (3), 145. —Studies were made on one bulk consignment of American variety (Lakshmi) seed with a view to arriving at the optimum conditions of crushing. From the results obtained, the following conclusions are drawn: Optimum conditions for processing Lakshmi (American type) seed are as follows:

- (i) Temperature of cooking: Top kettle = 80°-100°C. Bottom kettle = 110°-125°C.
- (ii) Moisture content of flakes prior to cooking: 12-13 per cent.
- (iii) Moisture content of cooked meats before entering the screw press: 3.5-5.0 per cent.
- (vi) Cooking time: 45-60 minutes.

Under the above conditions, the yield of oil obtained in a single crushing by modern process by a standard expeller driven by 15 H.P. is 11.5-12.4 per cent with an average of 12.0 per cent from the seed of oil content 19.6 per cent.

High temperature (110°-130°C) cooking of meats gives greater yield of oil (11.5-12.4 per cent) while low temperature cooking (85°-105°C) gives considerably lower yields of oil (1.3-3.8 per cent) but of lower gossypol content. The oils obtained by low temperature cooking are found to have better refinability (lower refining losses and lighter colour) than those for oils obtained by high temperature cooking.

Prolonged cooking of cottonseed meats for 6 hours seems to have no deleterious effect on the FFA and colour of the crude oil. While the free gossypol contents of the meats progressively decreased with the length of cooking the soluble proteins of the resultant cake also decreased, which is not an advantage.

It is also seen from the above studies that a cooking time of 45-50

minutes is desirable to obtain low gossypol and light-coloured oils.

The lipids in the humidified meats/flakes undergo lipolysis rapidly, on storage. Hence they should be processed for oil immediately after flaking.

Studies on the colourization of vanaspati, by Mukerji, B., *et al.*, *Ann. Biochem. exptl. Med.*, 1960, 20 (4), 105.—In order to find a suitable dye for the colourization of *vanaspati*, 12 dyes (synthetic and natural) were examined. Of these, one (*Ratanjot* root dye) was found to be somewhat promising and was selected for acute and chronic toxicity studies on rats.

The following results were noted:

- (1) Acute toxicity studies revealed no untoward effect.
- (2) In chronic toxicity studies, the histopathological examination of liver showed the incidence of fatty infiltration in some animals of the experimental as well as in one case of the control group. But the differences were not significant.
- (3) There were no evidence of any gross pathological changes in other organs.

From the data so far obtained, *Ratanjot* dye may be considered possibly as non-toxic or very little toxic in terms of the feeding experiments so far performed by us. It, therefore, appears to be acceptable as a colouring agent for *vanaspati*. However, long-term feeding expe-

riments need to be continued before a categorical statement can be made.

The iodine value decreasing reaction in fat autoxidation, by Kartha, A. R. S., *J. sci. industr. Res.*, 1960, 19B (6), 199.—The decrease in iodine value and the extent of hydroperoxide destruction during autoxidation of refined fats by aeration methods, under dynamic and static conditions, at 99° C have been investigated in order to re-examine the validity of current theories on fat autoxidation. The results of these studies have yielded new evidence which shows that long chain fat peroxides do not interact with double bonds to any appreciable extent in the autoxidation of fats under usual conditions. The decrease in iodine value during fat autoxidation appears to be brought about by an independent autocatalytic chain reaction which is inhibited by fat antioxidants, and is similar to, but distinct from and independent of, the autocatalytic hydroperoxide forming chain reaction which is also inhibited by fat antioxidants. During thermal decomposition, fat hydroperoxides appear to get destroyed due to intermolecular reaction involving elimination of water and considerable polymerization, as shown by increase in viscosity, but not involving any change in the degree of unsaturation. The evidence also indicates that, during autoxidation at 99-100° C a substantial proportion of the autoxidizing fat is probably converted to saturated products without passing through

the hydroperoxide stage or reacting with the products of the hydroperoxide stage. This is not in agreement with Farmer's autoxidation theory but appears to support the suggestion of Atherton and Hilditch that there are two different routes of autoxidation.

GENERAL

A method for a permanent record of chromatogram, by Idelman, S. and Sheshadri, B., *Curr. Sci.*, 1960, 29 (1), 21.—Chromatograms of amino-acids are difficult to preserve, as the colour of the bands fade away. The usual method of preserving it permanently is to photograph it. In view of the high cost of this method, the authors have developed an economical and simple technique, *viz.*, ammonia printing or dry printing method. After developing the chromatogram with ninhydrin, it is kept over the ammonia process paper. The two are then placed over a glass plate with the chromatogram facing the glass surface, tightly fitted into a frame and exposed to solar light. The time of exposure is governed by intensities of the light and the bands. On keeping the ammonia process paper immediately after the exposure in a chamber full of ammonia vapour, the dry printing paper is ready in 10-15 minutes. The bands are blue on a white background and the paper is an exact duplicate of the chromatogram. The advantages of this new technique of preserving the chromatograms permanently are given.

K.L.R.

PART III (Foreign)

ANALYTICAL

Determination of moisture content in cereals. Errors in the determination by oven drying of known changes in moisture content, by Oxley, T. A. and Pixton, S. W., *J. Sci. Fd. Agric.*, 1960, 11 (6), 315.—Water added to a soft wheat, whether as vapour (humid atmosphere) or liquid, was accurately assessed by the oven

method (heating 4 hr at 113°); but water added to a hard wheat by either method was over-assessed proportionately to the amount added. The over-assessment amounted to 1 per cent when the moisture content was increased from 9 per cent to 25 per cent, on the dry weight basis.

The amount of water removed from both varieties of wheat by

drying in a warm air current was over-assessed. That from the hard wheat was over-assessed proportionately to the amount removed (but only to the extent of about 0.25 per cent on drying from 25 per cent to 9 per cent on the dry weight basis), whilst the over-assessment was inversely proportional in the case of the soft wheat.

It is concluded generally that

the ability of an oven-drying method to measure known quantities of water in wheat is related to the type of wheat. This is consistent with results obtained in the first paper in this series.

Estimation of unsaturation of fats and oils using hypochlorous acid, by Basu Roy Choudhury, R., *J. Amer. Oil Chem. Soc.*, 1960, 37 (4), 198.—The extent of unsaturation in oils containing both non-conjugated and conjugated unsaturation has been estimated by earlier workers using hypochlorous acid. The main limitation of this method is the laborious process of preparing the hypochlorous reagent by passing washed chlorine through a 4N solution of NaOH at a temperature below 10° C and then diluting it to 0.1N. In the present investigation, the author has found that commercial bleaching solutions sold in the grocery stores, such as Chlorox, can efficiently serve as a reagent. Chlorox on acidification, yields hypochlorous acid which adds on to the double bonds quantitatively. Other substances present in Chlorox do not interfere in the method. The details of the procedures to be followed for determining the unsaturation of oils containing non-conjugated and conjugated unsaturation are given. Iodine number of different oils have been determined by using Chlorox and the results compare very well with those obtained by the Wijs method. The results of this study indicate that the use of Chlorox for the determination of unsaturation of fats and oils is very satisfactory and is easier than the Wijs method. The present method is particularly suitable for commercial and industrial laboratories.

K.L.R.

ANTIBIOTICS

Penetration of tetracycline antibiotics into tuna, sole, and rockfish flesh and their stability during steaming and retorting, by Lerke, P. A. and Farber, L., *Food Technol.*, 1960, 14 (5), 217.—The penetration into whole tuna and into fillets of sole and rockfish

of chlortetracycline and of oxytetracycline into tuna was studied. No effect of NaCl on the penetration into tuna flesh of the antibiotics was found. The skin and outer layer of flesh acted as a quite efficient barrier to the penetration of the antibiotics into the deeper layers of the meat. This decreased penetration facilitated subsequent destruction of active antibiotic during the steaming operation which is part of the tuna canning procedure. No active antibiotic residues were found in any cans of tuna packed from antibiotic-treated fish. The uptake of chlortetracycline by sole fillets was quite rapid during the first 5 minutes of immersion, after which the rate tended to decrease up to an hour. The chlortetracycline in sole and rockfish fillets was quite stable up to 7 to 9 days storage at 41° F (5° C); average losses during the storage periods were 16.8 per cent and 16.5 per cent respectively. Heat treatments of steaming, baking and frying, stimulative of home preparative procedures, were found to markedly inactivate the active CTC originally present in the fillets of sole and rockfish. The actual amounts of antibiotic remaining after the various heat treatments were very small and could be considered as relatively insignificant, particularly in view of the statement by the Food and Drug Administration on April 16, 1959, relative to the safety of any antibiotic residues in cooked seafood.

BIOCHEMISTRY AND NUTRITION

The effect of various dietary fats, especially butter and some margarines on blood cholesterol in rats, by Funch, J. P., Nielsen E. and Dam, H., *Brit. J. Nutr.*, 1960, 14 (1), 1.—The purpose of the three experiments reported here was to study the influence of dietary fat on the blood-cholesterol levels in male rats fed *ad lib* on the experimental diets from the age of 4 or 6 weeks.

In Experiment 1 cholesterol was

determined in the plasma of 159 rats distributed over eighteen groups fed for 18 weeks on diets containing 12, 24 and 48 per cent by weight of butter or one of five margarines.

In Experiment 2 cholesterol was determined in the serum of fifty-eight rats distributed over four groups fed for 36-45 weeks on diets with 24 per cent of butter or of one of three margarines. After 54 weeks on these diets half of the rats were killed for histological examination and cholesterol was again determined in the serum of the remaining rats which were used for Expt. 3. They were transferred to a diet containing 21.7 per cent maize oil instead of butter or margarine. Serum-cholesterol levels were again determined after 1 month and after 4 months on the maize-oil diet.

The butter diets consistently caused significantly higher blood-cholesterol levels than did the diets with margarines containing large amounts of hydrogenated whale oil. A change from these margarines to maize oil resulted in raised serum cholesterol, but a similar change from the other margarines or butter had no such effect.

The difference in chain length of the fatty acids present in butter and in those margarines containing large amounts of hydrogenated whale oil may have been partly responsible for the difference in effect of the two kinds of fat on plasma- or serum-cholesterol levels.

Chemical and nutritional changes in stored herring meal, by Lea, C. H., Parr, L. J. and Carpenter, K. J., *Brit. J. Nutr.*, 1960, 14 (1), 91.—Storage of herring meal (6.1 per cent moisture) in air for 12 months at 20° caused only small losses of available lysine as determined chemically. These losses amounted to 8 per cent for untreated meal and to 4 per cent for similar meal containing .0.025 per cent 2, 6-di-t-butyl-4-methylphenol.

When the meals were given at 3.1 per cent level in a chick assay for lysine, these small losses in available lysine produced no significant effects on growth or

efficiency of food conversion as compared with an unoxidized control meal.

When meal that had been stored in air for 3 months at 10° and had lost 4 per cent of its available lysine was heated for 30 hr at 100° in nitrogen a further loss of 12 per cent occurred. Fresh meal similarly heated in nitrogen lost no available lysine; at 85° in air 10 per cent was lost.

Further evidence of a reaction between fat oxidation products and protein was found in the higher 'bound' lipid and thiobarbituric-acid values given by oxidized as compared with fresh herring meal. Propanal reacted rapidly with 'dry' fish muscle producing marked losses in 'available' lysine and in nutritive value.

A commercial sample of herring meal which overheated and darkened badly during bulk storage lost about 60 per cent of its 'available' lysine and gave very poor results in the chick assay for lysine. Fresh and pre-oxidized meals heated in the laboratory for 30 hr in the absence of oxygen also darkened and at 115° lost 19 and 27 per cent, and at 130°, 67 and 69 per cent, respectively, of their available lysine.

Several anti oxidants, *i.e.*, 2,6-di-*t*-butyl-4-methylphenol, monobutylhydroquinone and especially diphenyl-*p*-phenylenediamine and 6-ethoxy-2,2,4-trimethyl-1,2-dihydroquinoline markedly reduced the rate of oxidation of the oil stored in herring meal. Citric acid showed only a weak synergistic effect with BHT. Preheating the meal before storage had some stabilizing effect.

Neither fresh nor oxidized (4 months in air at 20°) herring meal tainted the eggs or flesh of hens receiving it for up to 2 months as 8 per cent of their diet.

CEREALS

Examination of wheat gluten by partial solubility methods. I. Partition by organic solvent, by Meredith, P., Sammons, H. G. and Frazer, A. C., *J. Sci. Fd. Agric.*, 1960, 11 (6), 320.—Gluten from

defatted flour was purified by dispersion in acid and precipitation, and partitioned in a methanol-chloroform mixture. Similar partition of washed gluten and of flour gave results suggesting that a complex is split on treatment of gluten with dilute acid.

Amino-acid analyses of the fractions suggest that the properties of the more soluble fraction may be explained by a relative lack of ionisable groups. Comparison with the amino-acid composition of barley proteins may give an indication of the structural components responsible for the characteristic properties of wheat gluten.

Examination of wheat gluten by partial solubility methods.

II. Partition by dilute formic acid, by Meredith, P., Sammons, H. G. and Frazer, A. C., *J. Sci. Fd. Agric.*, 1960, 11 (6), 329.—When gluten is treated with dilute acid, swelling of the gelatinous component occurs with concomitant diffusion from the gel of the more soluble proteins. This process is independent of the partition by organic solvent described in Part I and the two processes may be applied consecutively in either order with substantially the same result. The resulting three fractions have been examined by viscosimetric and electrophoretic methods. The possible structure of gluten in terms of these fractions is discussed.

COFFEE

Analysis of coffee volatiles by gas chromatography, by Zlatkis, A. and Sivetz, M., *Food Res.*, 1960, 25 (3), 395.—Coffee aroma essence collected from commercial percolator vent gases has been separated and analyzed by gas chromatography and mass spectrometry. Dry vacuum aroma ether extracts have also been prepared from R and G coffee. More than thirty volatile components of roasted coffee which contribute to this aroma and flavour have been isolated and identified in this study. These compounds include mercaptans,

aldehydes, ketones, esters, acids, and heterocyclics. It is of particular interest to note the presence of low molecular weight hydrocarbons in coffee aroma essence.

DAIRY

Gas chromatography as a means of detecting odours in milk, by Wynn, J. D., Brunner, J. R. and Trout, G. M., *Food Technol.*, 1960, 14 (5), 248.—Gas chromatography was utilized to show the effectiveness of vacuum pasteurization as a means for removing the volatile feed flavours from milk. Approximately 85 per cent of the measurable flavour components of milk were removed by the vacuum pasteurization process with a resulting one-to-two point increase in flavour score. Characteristic gas chromatograms were obtained for the volatiles in milk from cows fed alfalfa silage, onion tops, or beet tops. Gas chromatography offers a valuable tool for the study of the effectiveness of deodorizing equipment as a means of removing the volatile flavour components of milk.

FERMENTATION

Organic acid metabolism in cider and perry fermentations.

II. Non-volatile organic acids of cider-apple juices and sulphited ciders, by Whiting, G. C. and Coggins, R. A., *J. Sci. Fd. Agric.*, 1960, 11 (6), 337.—The non-volatile organic acids of cider-apple juices and of ciders from sulphited fermentations have been separated using chromatographic methods, and identified. Several juice acids not previously detected were identified, namely, mucic, benzoic, gluconic and 2-methyl-2,3-dihydroxybutyric acid. During fermentation malic and gluconic acids often increased considerably in amount, appreciable quantities of succinic and lactic acids being formed together with small amounts of 2-methyl-, 3-methyl-, 2-ethyl- and 3-ethyl-dihydroxybutyric acids, fumaric, α -hydroxyglutaric and perhaps 2-ketogluconic acids; pectic degradation gave rise to appreciable

quantities of mono-, di- and tri-lacturonic acids.

FISH

The preservation of fish with ionizing radiation: bacterial studies, by MacLean, D. P. and Welanders, C., *Food Technol.*, 1960, 14 (5), 251.—The present study was undertaken to determine the effects of ionizing radiation at various levels on the bacterial flora of fillets of Pacific cod (*Gadus macrocephalus*) during storage in melting ice (0°C). The principle objectives were: (1) to compare bacterial counts of unirradiated and irradiated fillets (2) to identify bacterial genera present before and after irradiation and during storage. (3) to estimate relative numbers of bacterial genera at various levels of irradiation and intervals of storage and (4) an incidental study of micrococci present to assess their potential as food poisoning organisms. Irradiation of cod fillets at relatively low levels of gamma irradiation prolongs the bacteriological storage life at 0°C and appears particularly effective against the genera usually associated with the production of offensive odors characteristic of typical spoilage. In unirradiated control samples the genera *Micrococcus*, *Achromobacter*, *Flavobacterium*, and *Corynebacterium* predominated while *Sarcina*, *Pseudomonas*, *Alcaligenes*, *Mycoplana*, *Protaminobacter*, *Bacillus*, yeast (*Torulopsis*), *Aerobacter* and *Streptococcus* were in minor numbers. Irradiated samples showed predominant genera to be *Micrococcus*, *Sarcina*, *Achromobacter*, *Flavobacterium*, and *Corynebacterium* while *Alcaligenes*, *Bacillus*, yeast (*Torulopsis*), and *Mycoplana* were less numerous. Organisms of the genus *Micrococcus* appear to be resistant to radiation under conditions of these experiments. However the *Micrococcus* found do not appear to be typical food poisoning organisms.

FRUIT AND VEGETABLE PRODUCTS

Effect of variety, curing and processing on carbohydrate

content of precooked frozen sweet potatoes, by Hoover, M. W. and Pope, D. T., *Food Technol.*, 1960, 14 (5), 227.—An investigation was made to study the effects of variety, syrup concentrations and curing treatments on the carbohydrate content of sliced, precooked, frozen sweet potatoes. The sweet potato varieties included Porto Rico, Goldrush, NC 171, Redgold and Georgia Red. The roots were sliced and cooked in syrup solutions containing 0, 30, 45 and 65 per cent sucrose, by weight. Cured and uncured sweet potatoes were processed. The per cent total solids, total sugar and sucrose in the samples increased rapidly as the syrup concentration advanced from 0 to 60 per cent sucrose. The average per cent total sugar increased from approximately 9 per cent for samples cooked in water for 10 minutes to 21 per cent for those cooked in a 60 per cent sucrose solution. The apparent increase in per cent total sugar was accounted for almost entirely by an uptake of sucrose from the cooking media. On a percentage basis, there was a small increase in maltose and a decrease in reducing sugar as the syrup concentration advanced. There was little apparent change in per cent alcohol-insoluble solids and starch that could be attributed to syrup concentration. Wide variations in certain carbohydrate components existed among varieties. However, each variety responded similarly during the cooking process. Little variation in carbohydrates was found in frozen sweet potatoes that could be attributed to curing treatments. Weight losses occurred during the cooking process. In some instances it amounted to more than 7 per cent. The higher the syrup concentration the greater the weight loss. Weight losses varied widely among varieties, with Porto Rico having the least and Goldrush the highest.

Influence of blanching conditions on sloughing, splitting, and firmness of canned snap beans, by Van Buren, J. P., *et al.*,

Food Technol., 1960, 14 (5), 233.—Objective tests have been developed to give quantitative measures of the firmness of canned snap beans and their tendency to slough and split. These methods have shown that the blanching temperature was one of the most important factors affecting the sloughing of beans. Beans were blanched at temperatures between 150° F and 210° F with the result that, as the temperature was raised, the tendency to slough and split increased and the firmness decreased. When blanching was carried out at temperatures below 180° F increased blanching time led to less sloughing, while at higher blanching temperatures greater sloughing was the result of longer blanching times. The general firming effect of moderate temperature blanching continued to take place during the interval between blanching and retorting and was enhanced by holding the blanched beans at slightly elevated temperatures. Little or no change in firmness took place during holding periods following blanching at 190° F or higher. The tendency of beans to slough was increased by soaking them in oxalate and Calgon solutions prior to blanching, while this tendency was decreased by soaking in a calcium chloride solution.

Examination of lemon oil by gas-liquid chromatography. II. The hydrocarbon fraction, by Clark, J. R. and Bernhard, R. A., *Food Res.*, 1960, 25 (3), 389.—The hydrocarbon fraction (terpenes) of California cold-pressed lemon oil was examined by means of gas-liquid chromatography and a number of the components present were tentatively identified. α -pinene, camphene, β -pinene, myrcene, D-limonene, terpinolene, γ -terpinene, and *p*-cymene were the compounds identified in this fraction. A proximate analysis is presented for the composition of the terpene fraction of a typical California lemon oil.

Nitrogen compounds of cabbage. I. The relation of the non-

protein to the total nitrogen with special reference to the essential amino acids, by Kelley, E. G., *et al.*, *Food Res.*, 1960, 25 (3), 399.—

Non-protein nitrogen compounds of two strains of Copenhagen Market cabbage have been separated from the protein constituents by electro-dialysis, 70 per cent aqueous alcohol extraction and hot water extraction. Whole cabbage, extracts and residues have been analyzed for total solids, total nitrogen and α -amino nitrogen (Van Slyke N). Ten 'essential' amino acids have been quantitatively determined by microbiological methods in whole cabbage and in cathode fractions after electro-dialysis. Arginine, threonine and lysine have been compared in whole cabbage, electro-dialyzed, alcohol, and hot water extracts. The total nitrogen and Van Slyke N contents of these acids have been calculated and compared with the total N and Van Slyke N of whole cabbage and its separated fractions.

Total solids and total nitrogen values of the two strains of cabbage differed by as much as 30 per cent and 16 per cent, respectively, but the extractable solids and total nitrogen differed by only 2 per cent.

Total solids and nitrogen for the combined dialysate (cathode and anode) and the 70 per cent alcohol extract for each strain were in close agreement. The Van Slyke N of the Danish Copenhagen Market strain was about 6 per cent higher in the dialysate and 9 per cent higher in the alcohol extract than the Wisconsin strain. This was estimated to be due largely to the amide glutamine as determined by chemical methods described in a second paper of this series.

Hot water extracted a higher percentage of total N than either of the other methods. Total solids, total N and Van Slyke N in the various extracts and the residues from these extracts gave from 97 to 100 per cent recovery based on the values found in the whole cabbage.

Distribution of total nitrogen in the cathode and anode fractions

of the dialysate differed by as much as 10 per cent in different runs; this was thought to be largely due to the destruction of the amide glutamine which was broken down by electro-dialysis but not by alcohol extraction.

The amino acids arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine and valine were recovered quantitatively in cathode and residue fractions after electro-dialysis (± 10 per cent). Lysine recovery was somewhat variable in different sample runs and a little on the low side. Arginine recovery was about 20 per cent high when the cathode was not hydrolyzed before analysis and the recovery from the Danish strain was a little higher than that from the Wisconsin strain. Tryptophan was partially destroyed by electro-dialysis and yielded only 60 per cent of that found in hydrolyzed whole cabbage.

Arginine was the only 'essential' amino acid present in larger amounts in the soluble fraction than in the protein fraction.

Electro-dialysis and alcohol extraction methods were equally suitable for separation of nine of the essential amino acids but alcohol extraction is preferred if other amino compounds are desired. Electro-dialysis would be preferred as a method of separation of non-protein amino compounds from protein if the protein were to be used for further study.

Nitrogen compounds of cabbage II. Chromatographic analysis of the non-protein nitrogen, by Zacharius, R. M., *et al.*, *Food Res.*, 1960, 25 (3), 414.—Results of the chromatographic analysis of the non-protein nitrogen of Wisconsin Copenhagen cabbage are given.

Glutamine represents the major amino-nitrogen compound of the non-protein nitrogen fraction of cabbage. S-methylcysteine sulfoxide is second in concentration in this fraction while arginine represents a third major amino constituent. These three compounds provide 43 per cent of the Van Slyke

nitrogen of this fraction. The individual components assayed by the chromatographic method account for 76 per cent of the Van Slyke nitrogen value and 60 per cent of the Kjeldahl value.

The constituents of the crystalline deposits on dried fruit, by Miller, M. W. and Chichester, C. O., *Food Res.*, 1960, 25 (3), 424.

—The constituents of the crystalline deposits, responsible for the type of deterioration known as 'sugaring', on dried fruits have been determined by the use of paper chromatographic techniques.

Deposits found on prunes and figs contained glucose and fructose, traces of citric and malic acids and of lysine, asparagine, and aspartic acid. Apricot and peach 'sugars' contained, in addition, some sucrose and large amounts of asparagine and aspartic acid. Deposits from raisins were similar to figs with the exception that they also contained large amounts of tartaric acid.

Plating and microscopic examinations did not reveal the presence of yeasts which had been previously reported as a constituent of the 'sugar' depositions. This difference from the results of an investigation of the 'sugaring' problem 20 years ago might be the consequence of the different handling and drying techniques used now.

The red pigment of the root of the beet (*Beta vulgaris*) as a pyrrole compound, by Peterson, R. G. and Joslyn, M. A., *Food Res.*, 1960, 25 (3), 429.—The chemistry of the pigments present in the beet (*Beta vulgaris*) was investigated in some detail. Primarily from spectral evidence in the literature, it was believed that betanin is not a 'nitrogenous anthocyanin' as previously supposed. A more reasonable explanation was proposed in which the pigment was assumed to be a pyrrole compound. This conclusion is supported by all the available experimental data, including spectral evidence, type reactions and breakdown products.

The pigment was titrated and a measurement of pK values and

molecular weight was obtained. Reduction products of betanin were also studied. Carbon dioxide as methyl amine were identified as products of alkali fusion. A study of the yellow pigments was also made and it was found that some were easily transformed into red compounds. At least one yellow pigment was shown to be nitrogen-free, yet could be changed into a red pigment by standing in acid solution. Thus, it is likely that some of the red pigments may be nitrogen free. It is possible that these may be furan analogues of the pyrrole pigments.

Methods of pigment preparation were reviewed briefly and it was found that the variety of *Beta vulgaris* used was important in obtaining an impurity-free betanin. Selections from Green Top Bunching were found to yield pure pigment with relative ease.

MICROBIOLOGY

Radiation sterilization of food.

I. Procedures for the evaluation of the radiation resistance of spores of *Clostridium botulinum* in food products, by Schmidt, C. F. and Nank, W. K., *Food Res.*, 1960, 25 (3), 321.—Procedures have been suggested for the evaluation of the resistance of spores of *Clostridium botulinum* in food products subjected to ionizing radiation and have been illustrated by representative data. The occurrence of nontoxic spoilage yielding either strongly toxic or questionably toxic cultures has been noted. Although a mixture of strains, 3 type A and

2 Type B was used as inoculum, all survivors produced Type A toxin and it is suggested that the determination of radiation resistance with a suspension representing a mixture of strains is inadvisable. Approximately the same resistance of the inoculum was found in chicken parts, steak and whole kernel corn; survival at 2.8—no survival at 3.0 megarad; radiation D value 0.33-0.35 megarad. In pork loin resistance appeared slightly lower but on the borderline of significance. Resistance of the suspension appeared definitely lower in green beans based upon a comparison of D values.

OILS AND FATS

A report on the problem of residual solvent in solvent-extracted meals, by Gastrock, E. A., et al., *J. Amer. Oil Chem. Soc.*, 1960, 37 (4), 192.—The hazards of excess residual solvent in solvent-extracted meals and methods currently used for its measurement are discussed. Preliminary results are reported with a simple copper-cup flash-tester with concentric rings as heating surfaces. Solvent contents as low as 0.03 per cent can be detected. The method is semi-quantitative. The method may be useful for plant control purposes.

Continuous refining of crude coconut oil in a pressure system, by Sullivan, F. E., *J. Amer. Oil Chem. Soc.*, 1960, 37 (4), 195.—A continuous process for refining crude coconut oil has been described. This hermetic system provides a means for continually controlling the variables of time, temperature,

and reagent on a scientific, predictable basis. By utilizing the phase diagram as a guide for the correct conditions and employing a continuous process designed to maintain these conditions, it is always possible to obtain high yield refining results on crude coconut oil.

SPICES

Colour of capsicum spices, by Pohle, W. D. and Gregory, R. L., *Food Technol.*, 1960, 14 (5), 245.—The methods usually employed for evaluating the colour of capsicum spices are visual methods based upon comparison of the colour of a diluted extract with that of a specially prepared potassium dichromate-cobaltous chloride solution or with combinations of Lovibond glasses that match the colour of the solution. Visual methods are always subject to personal factors and the difficulties of comparing the colour of the extract with that of the standard solutions or colour glasses. These usually differ somewhat in hue or chromaticity. Recently, spectrophotometric methods have been proposed. A spectrophotometric method has been proposed by the authors for evaluating the colouring matter of paprika, oleoresin of capsicum and similar products. Better agreement among laboratories is expected by this method as the instruments are calibrated using pure beta-carotene. The colour is expressed as micrograms of carotene per gram of sample. Beta-carotene has colour characteristics similar to the colouring matter of capsicum and paprika.

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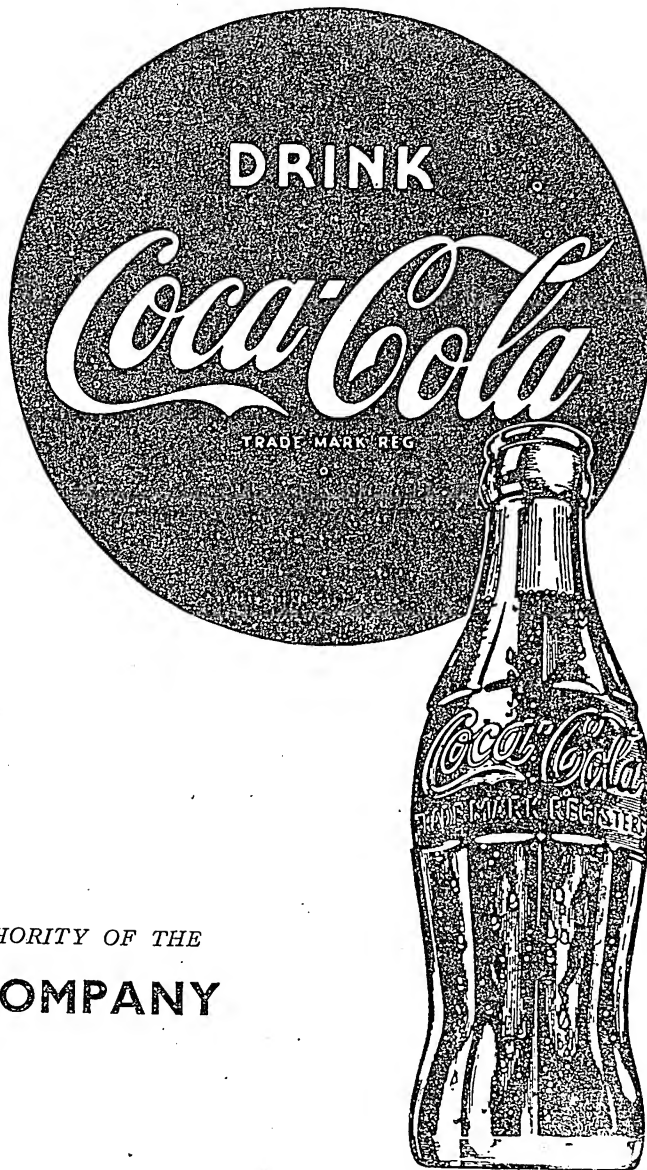
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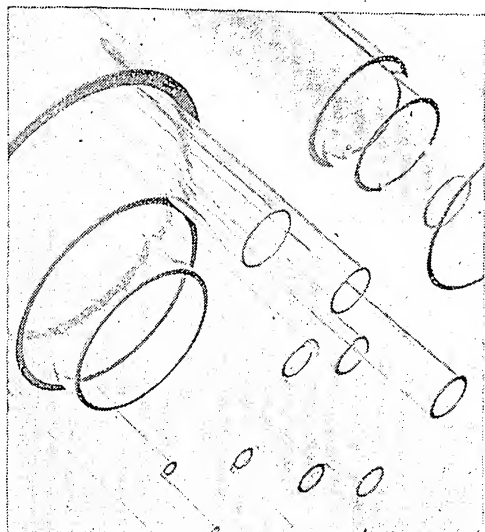
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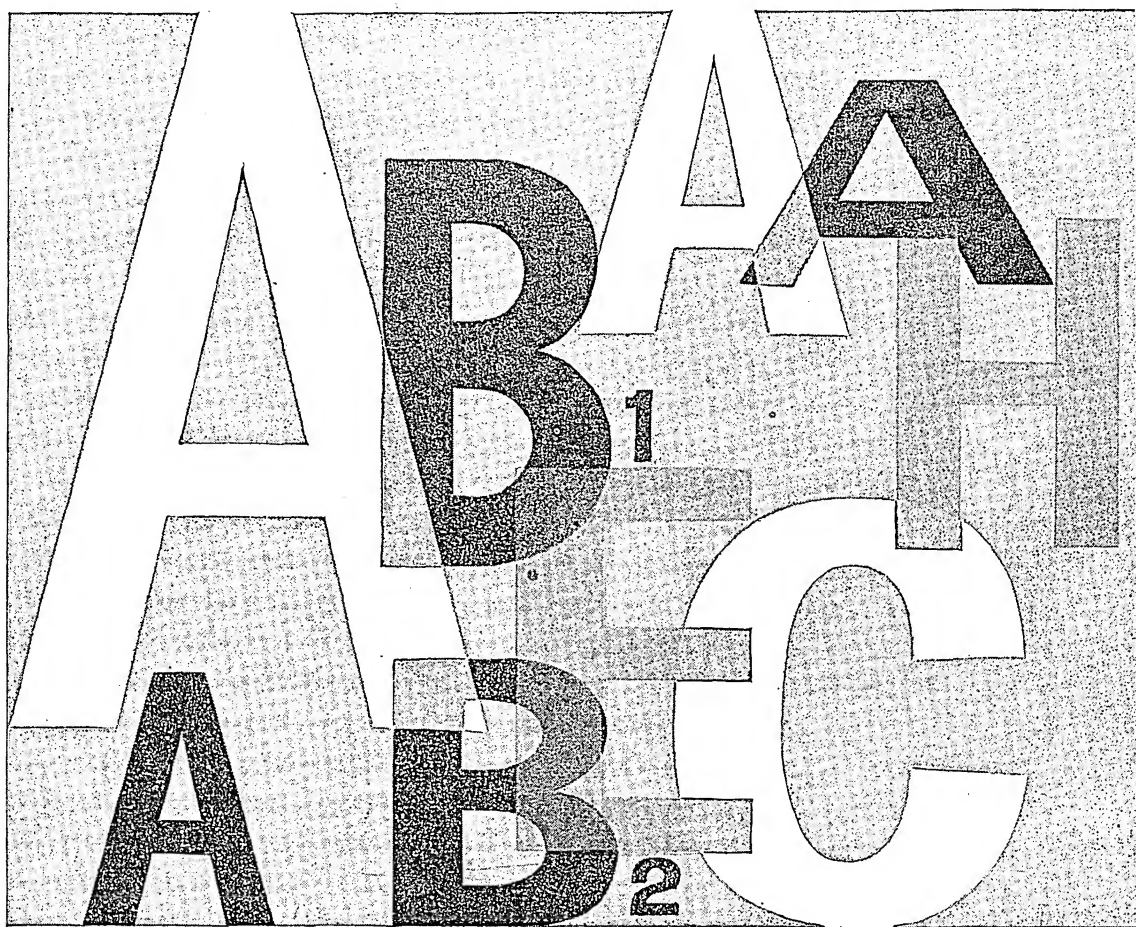
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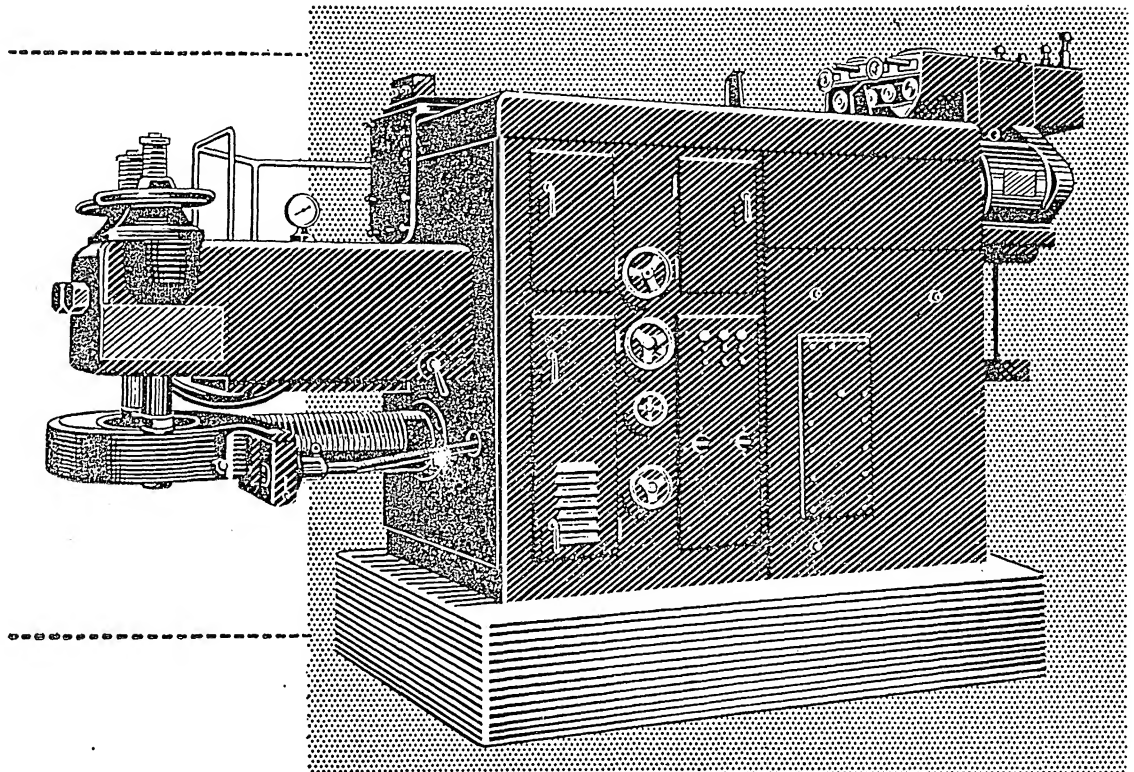
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1. SOME ASPECTS OF FOOD TECHNOLOGY IN INDIA (*published in August 1959*), pp. 160. (Editors—H. A. B. Parpia, R. C. Bhutiani, K. L. Radhakrishnan, A. N. Sankaran and B. V. Subbarayappa)

This is a publication specially brought out on the occasion of the F.A.O. Regional Seminar on Food Technology for Asia and the Far East held in Mysore from August 1-8, 1959. It is a collection of 26 review articles, which cover exhaustively the research work done in India on some of the important aspects of Food Science and Technology, particularly those dealing with rice and rice substitutes; fruit and vegetable products; dehydration of foods; storage, packaging and transport of perishables; infant, invalid and protein-rich foods; beverages, spices and condiments; etc. The book represents under one cover the important lines of work and progress made in India in the field of Food Technology.

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FRUIT AND VEGETABLE PRESERVATION INDUSTRY IN INDIA

(pp. xiv + 485)

This publication embodies the Proceedings of a Symposium held at the Central Food Technological Research Institute, Mysore, under the Presidentship of Late Dr S. S. Bhatnagar. More than 100 delegates from all parts of the country representing horticulturists, fruit and vegetable products manufacturers (both indigenous and modern), and allied industries like *Machinery, Additives, Packaging*, etc., participated in it.

The volume is packed with up-to-date technical and statistical data on several aspects of the Industry in more than 65 papers read and presented by scientists, technologists, industrialists, as well as importers and exporters of fruit and vegetable products. Besides, there are some papers which bring out adequately the various stages of development of the Industry in the country and the handicaps with which it is faced today. The inclusion of the discussions which followed each of the papers read, has added to the usefulness of the book. It also contains the Recommendations of the Symposium submitted to the Planning Commission for consideration in respect of schemes to be included in the Second Five-Year Plan, and a comprehensive subject index. The recommendations of the Symposium have already found their weight with the authorities concerned in taking appropriate steps for the systematic development of the Industry.

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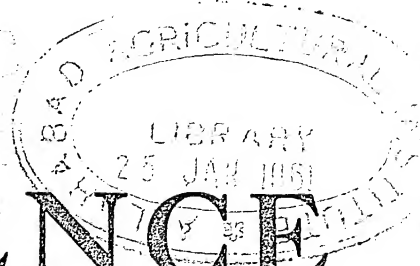
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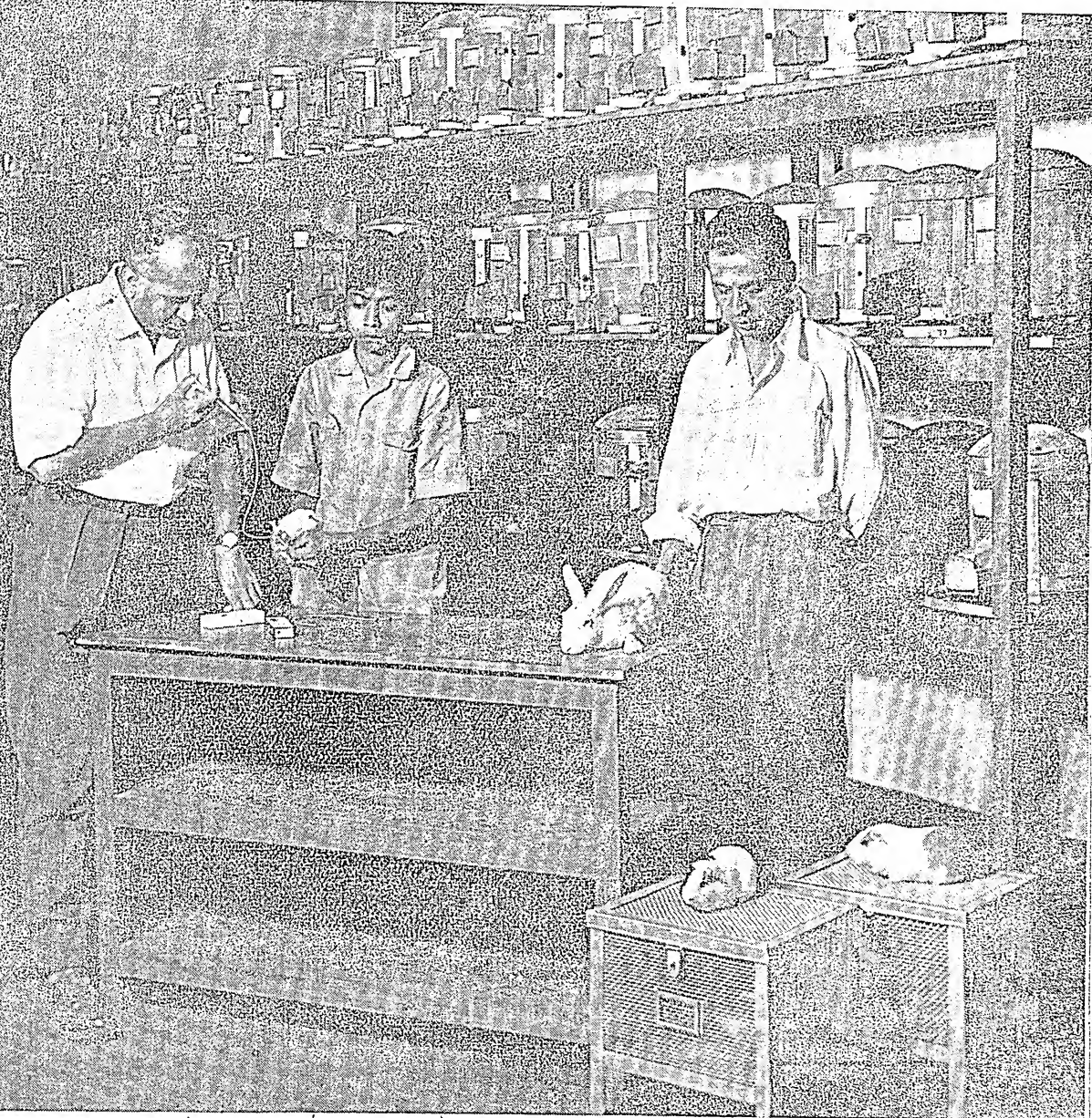
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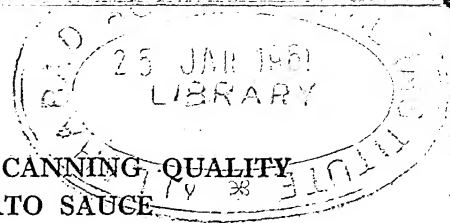
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EFFECT OF PRELIMINARY TREATMENT ON THE CANNING QUALITY OF LADIES FINGER IN BRINE AND TOMATO SAUCE

By S. RANGANNA AND G. S. SIDDAPPA

(Central Food Technological Research Institute, Mysore)

Ladies finger, when canned in brine, is soft in texture, mucilaginous and causes the covering liquid to be thick and viscous. Among the several preliminary treatments tried, blanching the cut-pieces of the vegetable in boiling water, soaking in 0.5% CaCl_2 solution for 30 minutes, washing and canning is preferable to other treatments. Even when prepared by this treatment, the canned product in brine tends to be mucilaginous and soft in texture. On the other hand, when canned in tomato sauce, the vegetable gives a product of good quality. The mucilaginous texture of the vegetable appears to blend well with the thick and viscous covering sauce in the can.

Ladies finger (*Okra* or *Bhindi*, *Hibiscus esculentus*) which is a rich source of minerals, lecithin and other phosphorus compounds, contains a mucilage which causes the covering brine in the can to become thick, viscous and mucilaginous. Further, the vegetable pieces tend to become soft and mashy on canning. Investigations carried out to overcome these defects are reported in this paper.

Several workers have studied the hydrolysis products of the mucilage^{1,2} and it has been reported to yield on partial hydrolysis a mixture of oligosaccharides³. The mucilage is used as a clarifying agent in the boiling of sugar-cane juice⁴.

The percentage composition of Ladies finger⁵ is as follows:

Moisture	... 88.0
Protein	... 2.2
Ether extractives	... 0.2
Ash	... 0.7
Crude fibre	... 1.2
Carbohydrates	... 7.7
Calcium	... 0.09
Phosphorus	... 0.08
Iron (mg)	... 1.5
Carotene (I.U.)	... 58.0
Thiamine (μg)	... 63.0
Nicotinic acid (mg)	... 0.6
Riboflavin (μg)	... 60.0
Ascorbic acid (mg)	... 60.0

Tender *okra* pods have been reported to be a good source of ascorbic acid containing as much as 42 mg/100 g. of fresh weight, which decreases with maturity⁶. Brining⁷ and some aspects of dehydration⁸ of Ladies finger have been investigated; there is, however, very little published work regarding the canning quality of this vegetable.

Experimental

Canning in brine: Tender Ladies finger obtained from the local market were used in the experiments. They were washed with water and subjected to various pre-treatments before canning as shown in Table 1.

Tender vegetables of small size were canned whole while large-sized vegetables were cut into pieces of $1\frac{1}{2}$ —2" size. They were treated as follows: In one case they were first blanched for two minutes in boiling water and then soaked for 30 minutes in 0.5 per cent calcium chloride solution. In the second case, they were blanched directly in boiling 0.5 per cent calcium chloride

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TABLE 1. *Effect of preliminary treatment on the quality of Ladies finger canned in brine*

Preliminary treatment	Vacuum (inches of mercury)	Head space (inches)	Refracto- meter solids at 20°C %	pH	Drained weight %	Covering liquid		Colour and texture of vegetable pieces
						Visco- sity* (Seconds)	Appear- ance	
1. Whole pieces blanched in water, cut into pieces and canned.	14.5	8/16	6.4	5.64	69.5	16.5	Slightly viscous flowing	Light green; mashy; soft; slightly mucilaginous
2. Vegetable cut into pieces, blanched in water, soaked in CaCl_2 solution and canned.	14.0	5/16	2.9	6.5	55.39	20.0	do	Light green; firm; slightly mucilaginous
3. Vegetable cut into pieces, blanched in CaCl_2 solution and canned.	8.5	1/4	4.9	6.6	67.19	109.0	Highly viscous	Light green; mucilaginous; very soft
4. Whole pieces blanched in water, soaked in CaCl_2 solution and canned as whole vegetable.	13.0	3/8	3.9	6.8	72.06	241.0	Very highly viscous	do
5. Whole pieces blanched in CaCl_2 solution and canned.	12.5	3/8	5.4	6.05	72.83	291.0	do	do
6. Soaked overnight in 2% salt solution, cut into pieces, blanched in water for 2 minutes, soaked in CaCl_2 solution and canned.	11.0	1/8	4.4	5.95	53.53	7.0	Thin watery	Slightly discoloured; firm; slightly mucilaginous
7. Soaked in hot 2% salt solution for 4 hours, cut into pieces, blanched in water, soaked in CaCl_2 solution and canned.	14.0	1/4	5.9	6.25	59.39	32.0	Viscous flowing	Pieces slightly discoloured; mashy; slightly mucilaginous

* Viscosity is expressed as time required for flow through No. 4 Ostwald viscometer in seconds. Time required for distilled water to flow through No. 4 Ostwald viscometer is 2 seconds.

solution for 2-3 minutes. In both cases, they were washed well with water to remove the excess of calcium. For convenience in conducting the trials, canning was done in plain cans of 301 x 309 size. 180 g. of the prepared vegetable was filled and covered with 140 g. of hot 2 per cent brine in each can. The cans were exhausted to a can-centre temperature of 180° F, sealed and processed for 30 minutes at 240° F, and cooled in water. They were then stored and examined periodically.

Canning in tomato sauce: The tender vegetable was blanched in boiling water or in 0.5 per cent calcium chloride solution and cut into pieces. The pieces were filled into plain or S.R. lacquered cans of 301 x 309 size, covered with hot tomato sauce and the cans exhausted to a

can-centre temperature of 180° F, sealed, processed at 240° F for 30 minutes and cooled. The sauce was prepared as per recipe recommended by Siddappa *et al.*⁹ for the canning of baked beans and was of about 18° Brix.

Results and Discussion

Data regarding the effect of various treatments on the drained weight, texture of the vegetable, viscosity of the covering brine and other important cut-out characteristics of Ladies finger canned in brine are given in Table 1.

To reduce the viscosity of the covering liquid, blanching the cut-pieces in water and giving of subsequent calcium treatment is preferable to mere blanching in CaCl_2 solution (Treatments 2 and 3). Similar treatment in the case of uncut

vegetable has, however, quite the reverse effect (Treatments 4 and 5). The covering liquid is almost like a jelly in consistency and there is consequently a considerable increase in the percentage of drained weight of the vegetable. Unlike in the case of the uncut whole vegetable, the cut-pieces lose most of the mucilage in them during blanching, calcium treatment and subsequent washing in water. In the case of the whole vegetable, however, most of the mucilage remains in the vegetable and in the presence of calcium, causes the covering liquid in the can to become highly viscous. Soaking the vegetable over night in 2 per cent salt solution has been recommended for the satisfactory canning of Ladies finger¹⁰. Experiments in this direction with slight modifications gave the following results:

Soaking the whole vegetable overnight in 2.0 per cent salt solution, cutting into pieces, blanching in water and soaking in CaCl_2 solution significantly reduced the viscosity of the covering liquid and also reduced the drained weight (Treatment No. 6). This treatment is, however, not recommended as a general practice, in view of possible bacterial contamination which increases the microbial load on the vegetable prior to canning. To minimise this contamination, the vegetable was soaked in 2 per cent hot salt solution. This caused the mucilage to come out into the surrounding medium and made the handling of the vegetable pieces difficult. Further, the covering liquid in the can was far more viscous than in the case of the product packed by adopting treatments 6 or 2, and the vegetable pieces were more mashy in texture. As a result of soaking in salt solution, the canned vegetable was slightly discoloured in appearance. Blanching the cut-pieces of the vegetable in boiling water for 2 minutes, soaking them in 0.5 per cent calcium chloride solution for 30 minutes and then canning them is preferable to the other treatments tried. The vegetable pieces, however, still remain slightly mucilaginous and the covering liquid slightly viscous, as compared to other canned vegetables. This should be tolerable in the case of this particular vegetable.

Ladies finger canned in tomato sauce was attractive, the vegetable pieces being firm and having good taste and smell. At the end of 9

months of storage at room temperature, the product had kept well (Table 2). Blanching in calcium chloride solution does not seem to improve markedly the texture of the vegetable. The product canned either in plain or in lacquered can had good colour and flavour, but there was heavy feathering in plain cans. The lacquer in S.R. lacquered cans was normal. The pieces were firm and not mucilaginous. The absence of mucilaginous nature may be due to its mixing up with the thick sauce, causing slight increase in viscosity of the sauce and at the same time reducing the mucilaginous texture of the vegetable.

TABLE 2. *Cut-out data for Ladies finger canned in tomato sauce after storage at room temperature (25-27°C) for 8 months*

	Whole pieces blanched in boil- ing water, cut into pieces and canned	Whole pieces blanched in 0.5% CaCl_2 solution, cut into pieces and canned
Vacuum (inch) ...	9.0	12.5
Head space (inch) ...	5/16	5/16
Refractometer solids of sauce at 20°C (%) ...	15.3	16.3
pH at 25°C ...	4.4	4.3
Drained weight (%) ...	70.92	56.67
Solid: Texture ...	Firm	Firm
Colour ...	Light green	Light green
Flavour ...	Characteristic	Characteristic
Covering liquid: Colour ...	Reddish brown	Reddish brown
Flavour ...	Sauce flavour	Sauce flavour
General Quality ...	Good	Good

Acknowledgment

The authors wish to express their sincere thanks to Dr V. Subrahmanyam, Director and Dr Girdhari Lal, Assistant Director, for their keen interest in this investigation.

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THE DISTRIBUTION OF PROTEIN, CALCIUM AND PHOSPHORUS BETWEEN THE FIBROUS SEED COAT AND ENDOSPERM OF JOWAR (*Sorghum vulgare*)

By P. P. KURIEN, M. SWAMINATHAN AND V. SUBRAHMANYAN

(Central Food Technological Research Institute, Mysore)

The distribution of protein, calcium and phosphorus between the fibrous outer seed coat and endosperm including the germ of two varieties and one market sample of jowar have been studied. The fibrous seed coat contains about 18 per cent of the protein, 20 per cent of the calcium and 13 per cent of the phosphorus present in the whole grain.

Jowar (*Sorghum vulgare*) is a grain of considerable importance to India¹ and is also cultivated in other countries such as Africa, China and U.S.A.² The flour contains 7-8 per cent non-available carbohydrates like cellulose and hemicelluloses³.

The low digestibility of the protein (55 per cent) reported in children subsisting on *jowar* diet by Kurien *et al.*⁴ was attributed to the presence of 7-8 per cent of unavailable carbohydrates in the grain. In the case of *ragi*, (*Eleusine coracana*), Kurien *et al.*⁵ found that 28 per cent of nitrogen, 49 per cent of calcium and 14 per cent of phosphorus were present in the husk. In view of this, it was considered desirable to study the distribution of protein, calcium and phosphorus between the fibrous seed coat and endosperm of *jowar*.

Experimental

Three samples of *jowar* were used in the study, two strains obtained from Annigeri Agricultural Demonstration Centre and the third sample being the same as that used in an earlier study.⁴ The grain was cleaned of impurities and one pound lot of each sample was powdered to pass through a 50 mesh sieve and used for analysis.

Separation of the husk and endosperm of jowar: A gravitational method described below, was employed to satisfactorily separate husk and germ from endosperm, as the mechanical and

wet processing techniques⁵ were not successful. It differs in certain details from the method described in literature⁶.

One kilogram of cleaned grain was soaked for 48 hours in three litres of water containing 0.05 per cent potassium metabisulphite. The soaked grain was ground in a micropulveriser using a 0.27 sieve and then mixed well with the soak water. The dilute slurry was sieved through a 100 mesh sieve to remove the starchy endosperm. The residue remaining on the sieve, containing the germ and the fibrous seed coat was then washed several times to remove the adhering starch almost completely. The residue was almost free from starch as indicated by weak iodine test and contained only the husk and the germ. It was suspended in water and the germ was separated by adjusting the specific gravity of the liquid (water) by the addition of sodium chloride, when it rises to the top and is removed by a fine sieve. The germ was washed with distilled water and added to the bulk of the endosperm. The fibre was dried in an air oven at 90° C.

The filtrate containing the starchy endosperm and the germ was centrifuged at 2000 r.p.m. and the clear supernatant removed. The residue containing the endosperm was spread out in a tray and dried in a current of air at 45-50°C. The supernatant was made up to a suitable volume and analysed separately.

TABLE 1. Protein, calcium and phosphorus contents of the fibrous seed coat and endosperm of three varieties of jowar (All values given on moisture-free basis)

(All values given on moisture-free basis)

Component	Component as per cent by weight of whole grain	Protein (N x 6.25)		Calcium		Phosphorus	
		%	as per cent of protein in the whole grain	mg/100g	as per cent of calcium in the whole grain	mg/100g	as per cent of phosphorus in the whole grain
<i>Whole grain</i>							
Kanavi	...	9.05	...	38	...	267	...
325	...	9.64	...	49	...	187	...
Market sample	...	7.70	...	37	...	245	...
Average	...	8.80	...	41.3	...	233	...
<i>Fibrous seed coat</i>							
Kanavi	9.6	17.10	18.1	86	21.6	398	14.3
325	10.4	16.03	17.7	90	18.7	228	12.7
Market sample	10.8	12.03	16.9	70	20.4	252	11.1
Average	10.3	15.05	17.6	82.0	20.2	292.7	12.7
<i>Endosperm</i>							
Kanavi	85.6	6.10	57.7	17	38.3	115	36.8
325	84.8	6.02	54.2	22	37.4	71	32.4
Market sample	84.2	5.27	56.4	16	36.2	85	29.1
Average	84.9	5.80	56.1	18.3	37.3	90.3	32.8
<i>Dried solids from the supernatant</i>							
Kanavi	3.6	59.33	23.6	405	38.4	3575	48.2
325	4.2	65.44	28.5	501	42.9	2391	53.8
Market sample	3.2	62.90	26.1	494	42.7	4495	58.7
Average	3.7	62.55	26.1	466.7	41.3	3487	53.6

The whole grain, the separated fibrous seed coat, endosperm containing the germ and the supernatant were analysed for protein, calcium and phosphorus by the methods of A.O.A.C.⁷ The results are given in Table 1.

Results and Discussion

Protein: It is of interest to note that the endosperm including the germ contains about 56 per cent, aqueous extract 26 per cent and the outer fibrous seed coat only 17.6 per cent of the total protein present in the whole grain.

Calcium: Jowar is a poor source of calcium as compared to ragi⁸. Unlike ragi⁵, only a fifth of the total calcium is present in the fibrous seed coat. About 80 per cent of the total calcium is present in the endosperm including the germ and in the supernatant solution.

Phosphorus: About 75 per cent of the phosphorus is present as phytate phosphorus^{9,10}. The fibrous seed coat contains only 12.7 per cent of

the total phosphorus. The endosperm and supernatant contain about 87 per cent of the total phosphorus.

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FREEZE-DRYING OF PASSION FRUIT JUICE*

By J. S. PRUTHI

(Central Food Technological Research Institute, Mysore)

The results on freeze-drying of passion fruit juice reveal only negligible losses of important nutrients. The powder retains ascorbic acid to a high degree (168 mg./100g.) and flavour is only slightly reduced. The product retained its quality when vacuum-packed with in-package desiccant and stored at low (5°C) temperature. The overall quality of the product during storage was to a great extent a function of storage temperature and initial moisture content.

The processing of purple passion fruit juice (*Passiflora edulis* Sims.) for beverages has been receiving greater attention than before, particularly in Hawaii, South Africa, Australia and India. Earlier attempts relate to heat concentration of passion fruit juice¹, four-fold concentration by freezing² and vacuum concentration of a 1:1 blend of passion fruit and pineapple juices.³ Vacuum concentration followed by dehydration^{4,5} has not yielded very encouraging results because of the thermo-labile nature of its flavour. There has been no attempt so far to freeze-dry passion fruit juice with a view to retaining its delicate flavour. The present paper embodies the results of a study on the effect of laboratory-scale freeze-drying of passion fruit juice and the effect of in-package desiccation, vacuumization and storage temperature on physico-chemical composition, reconstitution and overall acceptability of the product.

Experimental

The process of freeze-drying was completed in three stages: (1) preliminary freezing of the product; (2) primary drying (sublimation of ice under high vacuum with rapidly applied and closely controlled heat) and (3) secondary drying when all the ice was sublimed and the residual moisture was removed from the powder obtained by ordinary vacuum dehydration.

(1) *Preliminary freezing*: Passion fruit juice (14.4° Brix) was frozen in $\frac{1}{2}$ lb. lots in 32 stainless steel trays ($10\frac{1}{4} \times 6\frac{3}{8} \times 1\frac{1}{8}$ ") in a room at 0°F with some trays pre-coated with an ice layer approximately $\frac{1}{10}$ " thick at the bottom. Other trays were coated in a similar way to obtain an ice layer on the top of the frozen juice layer, some *with* or *without* the bottom ice layer. This pre-freezing technique adopted by Mellor⁶ helps to produce uniform drying.

(2) *Primary drying*: The trays were loaded into a medial type freeze-drier with electrically heated shelves and on closing the vacuum chamber, the pressure was reduced to operate at 0.1 mm. Hg. in about 50 minutes. Loading caused a rise in temperature of the product by 2 or 3°C during the first hour. Thereafter, the evaporative cooling caused the temperature to drop to nearly -30°C where it was held for approximately 24 hours with only the heat of sublimation by external radiation being supplied. With this temperature and heat input, the surface layers of the product were carefully dried. The greater part of water was then removed by the combined effect of radiation from the warm walls of the vacuum chamber (equivalent to evaporation rate of 2 lb. of water/day) and electrical heating (equivalent to an evaporation rate of 4-5 lb. of water/day) which caused the temperature to rise to -17°C; this temperature was controlled until self-cooling was insufficient to keep the temperature down. Gentle warming caused the temperature to rise until the residual ice melted away. The condenser temperature and vacuum during this sublimation stage were fairly constant at -62°C and 0.1 mm. Hg. respectively.

(3) *Secondary drying (Ordinary vacuum dehydration)*: Electrical heat was continued to remove the residual moisture; the temperature was raised to 20°C and maintained. The condenser temperature and pressure were slightly lower. At the end of evaporation under reduced pressure, the trays were quickly unloaded and transferred to a low humidity room (6 per cent R.H.).

(4) *Packaging*: The porous product was scraped off, powdered as quickly as possible, and promptly packed in 202×214 G.P. lacquered

* Work done at the Division of Food Preservation & Transport, C.S.I.R.O., Homebush, N.S.W., Australia, during the author's tenure of Senior Fellowship under the Colombo Plan.

cans, divided into 6 lots and sealed after the following treatments:

Si. No.	TREATMENTS	
	In-package desiccant	Vacuum (inches Hg.) at the time of sealing
1	Nil	27"
2	Nil	0"
3	5g/can	27"
4	5g/can	0"
5	10g/can	27"
6	10g/can	0"

5 or 10 g. of reactivated and powdered *Desiccite* No. 25*, having a moisture absorption capacity of about 33 per cent (w/w) and sealed in small *Vitafilm* (cellulose acetate film) bags, was employed as the in-package desiccant.

Methods of analysis: Initial analysis of the single strength juice as well as freeze-dried juice for moisture, soluble solids, pH, acidity and sugars, was conducted by employing standard A.O.A.C. methods⁷. Ascorbic acid was estimated colorimetrically by the method of Robinson and Stotz⁸ and carotene by the method of Association of Vitamin Chemists⁹ as per cent reflectance of the samples with the help of a Hardy's recording spectrophotometer.

Reconstitution and organoleptic quality: Weighed quantity of powder was mixed with water in the ratio of 1:7 as determined previously⁴, stirred well for 1-2 minutes and submitted to a tasting panel comprising six technical members of the staff. The results are discussed below.

Results and Discussion

Physico-chemical aspects of juice and powder: (a) **Juice:** The physico-chemical composition of the passion fruit juice employed in this investigation was as follows: moisture, 83.91 per cent; refractometric solids corrected to 20°C, 14.40 °Brix; true ascorbic acid, 27.64 mg/100 g.; carotene expressed as I.U. of vitamin A per 100

g. of juice, 787; pH, 3.1; acidity as anhydrous citric acid, 3.45 per cent w/w; total sugars as invert 11.01 per cent; reducing sugars, 5.72 per cent and non-reducing sugars as sucrose, 5.03 per cent.

(b) **Powder:** There were negligible losses in the important nutrients of the juice during freeze-drying. The initial ascorbic acid of the juice powder ranged from 166 to 172 mg/100 g. with an average value of 168.2 mg/100 g. There were negligible losses in carotene. The moisture content ranged from 1.1 to 2.0 per cent.

Reconstitution and organoleptic examination: Provision of ice layers above and below the frozen juice layers in the trays produced a powder with little or no gummy particles, whereas in control trays and in trays partly covered, the product was somewhat gummy. The reconstitution of these powders, however, in cold or warm water was almost immediate, even the gummy particles dissolving without much difficulty.

Organoleptic evaluation of the reconstituted juice by the tasting panel did not reveal any significant difference from the parent juice, though the reconstituted juice had slightly less aroma.

Storage aspects: All the sets were examined after 16 weeks of storage. The over-all quality of the product was, to a great extent, a function of storage temperature and initial moisture content. The spectral reflectance curves in Fig. 1 show that higher storage temperatures cause deterioration in colour which is minimum at 5°C and maximum at 55°C. The juices reconstituted from these stored powders exhibited similar trend to a lesser degree.

The flavour retention after 16 weeks' storage was excellent and maximum at 5°C with a slight deterioration at room temperature (20-25°C). The deterioration was marked at 37°C; at 55°C the samples turned dark brown and were devoid of any flavour.

Use of in-package desiccant and vacuum packaging helped in better retention of colour, flavour, texture and over-all quality during storage at low or room temperatures. Ascorbic acid retention was better in vacuum-packed samples than in controls. After 16 weeks' storage at 5°, 20-25°, 37° and 55°C, the losses in ascorbic

* A patented product of Messrs. Filtrol Corporation, N.Y.

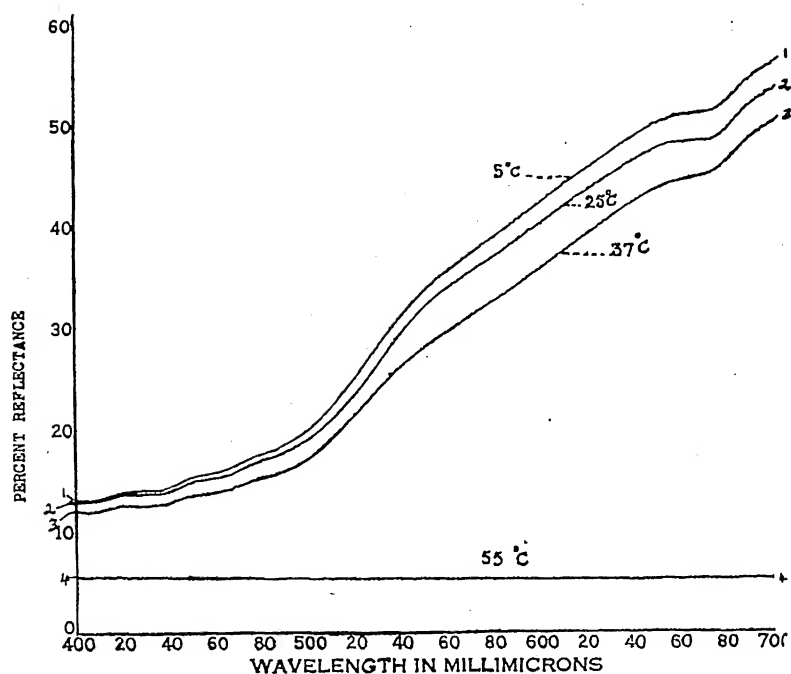


FIG. 1. Spectral reflectance curves for freeze-dried passion fruit juice after 16 weeks' storage at different temperatures. (Measurements made with a Recording Spectrophotometer equipped with reflectance attachment).

acid in vacuum-packed samples with in-package desiccant were 6, 20, 38 and 85 per cent respectively. There was no significant difference between the two treatments of in-package desiccant, both being superior to control in respect of better retention of ascorbic acid, colour, flavour and texture.

Vacuum-packed samples stored at room temperature and at 5°C were also examined after about one year's storage for over-all quality. Samples stored at 5°C retained their flavour well while those stored at room temperature did show some deterioration. The ascorbic acid losses in vacuum-packed samples stored at these two temperatures were of the order of 10.5 and 43 per cent respectively.

It is concluded that the product retains its quality very well when vacuum-packed with in-package desiccant and stored at 5°C.

It may be worthwhile to mention here that in pilot-plant freeze-drying of any fruit juice or foods, the production costs are high due to the expensive equipment employed and

high operation costs for removing water vapour under high vacuum. Despite these limitations, the application of freeze-drying has recently been extended overseas to the dehydration of several foods¹⁰ (orange and pineapple juices, vegetables, coffee and tea extracts, meat and fish fillets, cheese, etc.). Freeze-drying is particularly suitable for food products like passion fruit juice which have thermo-labile flavour. What is needed at the present moment is the development of an equipment suitable for the initial sublimation but providing vacuum dehydration for the greater part of the process. This should cause considerable saving in the running costs.

Acknowledgment

The author's grateful thanks are due to Messrs Coote's are due to Messrs Coote's Passion Ltd., Sydney, Australia for the gift supply of passion fruit juice for this investigation, to Mr J. D. Mellor for the valuable help in freeze-drying the juice, to the authorities, Division of Food Preservation, C.S.I.R.O., Homebush, Australia for the facilities provided and to the Director, Central Food Technological Research Institute, for the opportunity provided to the author to visit overseas.

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Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during September 1960 are given in this section.

S (IS) 22

Role of plant growth regulators in extending the storage life of perishables, by H. C. Srivastava (September 5, 1960).—Recently, growth regulators have been successfully used in encouragement of the roots, control of flowering, fruit setting, inducing parthenocarpy, etc. But scanty literature is available as to their efficacy on prolonging the storage life of perishables. The plant growth regulators could be successfully used as post-blossom, pre- and post-harvest treatments of fruits and vegetables in order to extend their storage life and reduce subsequent spoilage during transportation and storage.

The speaker then discussed the possibilities of the application of plant growth regulators on various commercial fruits and vegetables, and their limitations. The fundamental problems arising from the use of plant growth regulators with particular reference to their behaviour when used in small and large doses and on different stages of maturity were explained. The storage life of perishables can be extended by storing them at optimum low temperatures, treating them with various wax emulsions, etc.; but even under these conditions, their life is limited due to sprouting, rooting and spoilage during transportation and storage. Some of the perishables such as potatoes, onions, garlic, carrot, turnip, etc., which cannot be stored for long due to their rooting and sprouting nature, could successfully be stored by the use of growth inhibitors.

Potatoes could be successfully cold-stored at 35-38°F and 85-90 per cent R.H. for a period of 7-9 months, but during this storage, loss

due to sprouting is considerable. Further, for processing potatoes, they should be stored at a higher temperature, and sprouting is a limiting factor for the storage of potatoes at room temperature. Therefore, an experiment was conducted in 1953-54 to evaluate some of the plant growth regulators in inhibiting the sprouting of potatoes during refrigerated storage. Data were presented on the efficacy of various concentrations of terpineol, amyl alcohol, Belvitan-K and MENA on inhibition of the sprouting at different temperatures. It was found that there was no significant difference in the use of 1.2, 1.8 and 2.4 c.c. of terpineol per 20 lb. of potatoes as regards the percentage of sprouting and physiological loss in weight. Further, in another experiment, comparison was made between 1.8 c.c. of terpineol per 20 lb. of potatoes, post-harvest treatment with 1,000 p.p.m. of MH-40, 2 c.c. of amyl alcohol, and 10 g. of Belvitan K per 20 lb. of potatoes. It was found that Belvitan-K reduced the sprouting as well as the spoilage during storage and their storage life was extended at all the temperatures. Since Belvitan-K contained MENA in Talc, another experiment was set up wherein MENA was used as post-harvest treatment at 0.3, 0.4 and 0.5 per cent and it was observed that in all the 3 concentrations, there was no sprouting and the spoilage was considerably reduced.

The speaker further presented the data on extending the storage life of onions by pre-harvest application of MH. MH in the concentration of 20 p.p.m. was sprayed on leaf tips in the field 10 days before harvest. Subsequent crop was stored at various temperatures and it was found that all the three

concentrations reduced rooting and sprouting at room temperature as well as cold-storage. It was very interesting to note that 400-600 ppm concentration eliminated spoilage completely. It was also noticed that the action of these plant growth regulators was maximum on the second phase of the respiratory drift during storage at both temperatures, whereas there was not much difference between treated and control in first and second phases of respiratory drift. In another experiment, in which onions were inoculated with *Aspergillus niger* and *Rhizopus nigricans*, it was found that the hormone treatment definitely induced resistance to onion bulbs against these organisms.

The speaker then outlined as to how these plant growth regulators could be successfully used in shifting the climactic, influencing maturity and ripening, and induction of resistance against microbiological spoilage in a number of commodities. He also discussed some of the experiments underway on guavas, ginger and carrots. He referred to the experiments which have been planned to study the effect of steeping of the seeds with different plant growth regulators on subsequent germination, storage life of the commodity and spoilage during storage.

The talk was followed by a lively discussion in which the important points raised were: mode of action of the growth regulators, possible carcinogenic effects, need for doing similar work on mangoes, histological studies of ripening process in natural and treated samples, whether maleic hydrazide has any fungicidal activity, etc.

Answering the questions, the speaker explained the mode of action of growth regulators on the

meristematic tissues of the plant and said that only such plant growth regulators were used which were not toxic or carcinogenic in their action. It was pointed out that the action of regulators, particularly 2-4-D, used on guavas at the rate of 1-20 ppm accelerated the maturity and helped ripen all the fruits 15 days earlier than the control. At the same time, use of 100-1000 ppm of MH-40 retarded the ripening by about 20-25 days; thereby both these growth regulators could be successfully used to increase the season of guavas by about 1-1½ months. Similar experiments could also be conducted in pineapples to reduce the size of the crown. In one of the experiments with beans from the Sewage Farm, it was found that the spoilage was much less in the growth regulator-treated beans than in the control. The regulators cannot, probably, be used as systemic fungicides as their action is mainly on the growing tissues.

Winding up the discussion, the President observed that the application of these regulators in relation to the storage and transportation of perishables was a fascinating field and results so far obtained should be applied and experiments carried out on a larger scale with the help of different cold storages in the country. Compositions similar to plant growth regulators and easily available can also be tried out. The taste, flavour, etc., of the treated material with respect to 'consumers' acceptability must be ascertained. He said that there was considerable scope for this new field.

S (IS) 23

Pilot plant investigations on papain, by G. V. Krishnamurthy (September 19, 1960).—Papain is the dried latex from unripe papaya (*Carica papaya*). It is a strong proteolytic enzyme which finds wide use in food industries for tenderizing meat, chill-proofing of beer, predigesting of oilseeds; in the tanning industry for bating and dehairing hides; in the textile

industry for degumming of silk fabrics and preshrinking of wool; in the rubber industry for coagulation of raw rubber and in pharmaceuticals for several preparations. In recent years, papain is being utilized in fairly large quantities by several Indian industries and is imported from foreign countries. In order to meet this internal demand and to develop an export market for papain, work on an integrated process for the preparation of papain and pectin from raw papaya has been undertaken in this Institute on pilot plant scale.

Papayas of about 3 months old after setting, were selected from the plantations at the Sewage Farm, Mysore. Trees were divided into 20 batches, 4 to 6 trees in each batch, and marked for tapping. Fruits in each batch were lanced 6 times in the course of 16 days. The latex collected from each tapping was weighed, passed through a 50 mesh sieve, 0.5 per cent potassium metabisulphite (KMS) added and then dried in a vacuum shelf drier at 55°C for 3 to 4 hours. Dried crude papain was packed in jars and stored at 0°F. Tapped fruits were utilized for the preparation of pectin.

Statistical analysis of 15 batches consisting of 66 to 128 fruits (average 97), weighing about 154 to 364 lb. (average 277 lb.), showed that the yield of latex was highest in first tapping and the least in the 4th to sixth, with a batch average of 0.94 per cent (range 0.54 to 1.57 per cent). The yield of crude papain was highest in the first two tappings and gradually decreased in subsequent tappings, the average batch yield being 0.28 per cent (range 0.15 to 0.47 per cent). Total solids in the latex were highest in the second and lowest in the first tapping, with a range of 11.1 to 54.9 per cent. The yield of papain with 6 tappings was about 25 per cent higher than with 4 tappings. It was, therefore, considered desirable to tap the fruits 6 times. The native activity of the crude papain, by the milk clotting

method, was highest from the first two tappings.

Different chemical treatments and drying conditions of the latex showed that the addition of 0.5 per cent KMS to the latex improved the activity of crude papain considerably when prepared by sun-drying and only slightly when prepared by vacuum drying. There was no further improvement in the activity of crude papain on adding 0.2 per cent thymol to the latex that had already been treated with 0.5 per cent KMS.

Potassium cyanide and cysteine activated papain at 0.1 M and 0.05 M concentrations respectively. Hydrogen sulphide, at all concentrations, caused inhibition in freshly prepared crude and purified papain samples. It was found that the inhibitory effect of H_2S was not due to any impurities either in the milk powders or in the papain samples. The loss in activity caused by H_2S amounted to about 50 per cent by the milk clotting method and only 10 per cent by the protein digestion method. The inhibitory effect of H_2S was not observed in the presence of KCN. Contrary to this, stored and deteriorated samples as well as samples oxidised with iodine and hydrogen peroxide, were found to have increased activities on treatment with H_2S . In all these cases, however, only about 25 per cent of the initial activity could be restored either by H_2S or by KCN. Fractionation of freshly prepared crude papain yielded 14 different fractions by alcohol precipitation, out of which only 8 were enzymatically active. All the fractions were partially inhibited by H_2S . In the case of the stored samples, the fifth, sixth and seventh fractions, i.e., fractions precipitated with 55 to 67 per cent concentration, were affected by H_2S . The nature of the factor which is responsible for the partial inactivation of papain with H_2S needs to be investigated.

Referring to the storage studies, the speaker said that papain samples stored under vacuum were

quite stable at 37°C for 10 months. The behaviour of samples packed in cans or in colourless or amber-coloured bottles was almost similar and showed a deterioration of about 86 per cent activity in all the cases. Purified samples and samples treated with thymol were least stable during storage.

The points raised during the discussion related to the quantity of fruits used and the area worked on for the pilot plant studies, effect of variety on the yield of latex, feasibility of reducing the number of tappings of the fruit so that the tapped fruits could be stored much longer, need for studying the effect of H_2S by more specific methods as compared to the milk clotting activity, possible influence of the impurities in H_2S on the inhibition effect, effect of virus infection of the fruits on the H_2S activation, purification of papain as mercury salt, role of potassium metabisulphite, effect of KCN on the sample inhibited by H_2S , whether colour is an index of quality of the enzyme, whether quick-drying helps in in-

creasing the activity of the enzyme, effect of moisture content on storage behaviour, effect of H_2S on dialysed enzyme, possibility of obtaining papain from other parts of the papaya tree, etc.

Answering the points, Mr B. S. Bhatia and the speaker said that about half an acre of papaya plantation and about 300 lb. of fruits per batch were used. It was found that six tappings gave about 25 per cent more yield of latex as compared to four tappings without in any way affecting the fruits. Sufficient precautions were taken to purify the H_2S by passing through water traps. They said that addition of KMS would help in preventing the deterioration of the enzyme during drying. Colour may to some extent indicate the quality of the enzyme. Quick drying does help in better retention of the enzyme activity. It is known that papain is present in very small quantities in other parts of the tree like stems and leaves.

Winding up the discussion, the

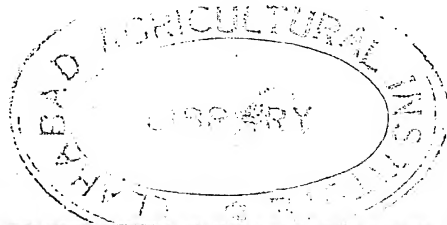
President said that sprinkling of a little water and stirring the latex would cause coagulation and might reduce the drying period. It is necessary to study the packaging aspects of the enzyme extensively.

The papain powder can be packed in evacuated containers or in the form of a tablet. Referring to the results reported on the effect of H_2S , he observed that the effect could be studied by adding H_2S after the enzyme had acted for some time on the substrate. He mentioned that in practice, it might be difficult to market the tapped fruits. It is therefore necessary to have an integrated process for the preparation of papain and pectin. It would be worthwhile to evolve some technique to tap the latex without affecting the fruits, possibly from other parts of the plant. This may help in getting better or additional yields and also to prevent coagulation of the latex on the fruit. He concluded that we should show definitely that papain could be prepared economically.

Chewer's favourite

**ASOKA SCENTED
BETELNUT POWDER**

Manufacturers: M. K. Krishna Chetty, Post Box No. 106, Coimbatore



Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Essential oil of mustard

E (IS) 76

Please furnish the details of the method of preparation of essential oil of mustard. (Patna).

The essential oil is obtained from the seeds of black mustard after expressing the fixed oil. The pressed cake is macerated in water at 60-70°C for several hours when reaction takes place between the glucoside 'sinigrin' and the enzyme 'myrosin' present in the seed, resulting in the liberation of allyl isothiocyanate, the main constituent of the oil. The essential oil consists of 93-98 per cent allyl isothiocyanate with traces of carbon disulphide and allyl cyanide.

In the case of white mustard, however, sinalbin occurs in place of sinigrin of black mustard. Sinalbin does not itself impart a pungent flavour to the condiment but is split up by the enzyme, myrosin. The products in this case are parahydroxybenzyl isothiocyanate or sinalbin mustard oil—a non-volatile substance with a pungent taste but without a pungent odour, sinapin hydrogen sulphate and dextrose.

Artificial mustard oil or essence obtained by the dry distillation of potassium allyl sulphate and potassium thiocyanate or by heating allyl bromide with an alcoholic solution of potassium thiocyanate. It is largely used in place of natural oil of mustard.

Cashew kernels for marketing

E (IS) 77

I shall be thankful if you can enlighten me on the method of removal of cashew kernels from the nuts, peeling and packing the same for local and overseas markets. (Mathurai).

We have not done any work in this Institute on the removal of cashewnuts from the shell. The process, of course, is very simple and consists of the following important operations:

(1) *Roasting of the nuts:* The raw cashewnuts are roasted in a rotary cylinder made of steel plates fitted slantingly in a suitable furnace. The cylinder is slowly rotated with proper gears. The raw nuts are fed at the feed end of the roaster when the cylinder plate is sufficiently hot. The nuts catch fire inside the cylinder and within one or two minutes they fall out at the discharge end where the fire is quenched by a spray of water. The roasting in a rotating cylinder has definite advantages over the open pan roasting as it yields minimum scorched kernels and pieces. The equipment required is fairly simple and cheap.

(2) *Shelling:* The outer shell or pericarp of the above roasted and cooled nuts is broken by gentle hammering by rectangular wooden piece and then the inside kernel is removed.

(3) *Peeling:* The kernels obtained after shelling are heated in a suitable drier under controlled conditions and then after cooling the outer red skin is scraped off by small knives.

(4) *Grading:* The peeled kernels are graded according to size and colour.

(5) *Packing:* These graded kernels are packed in 4 gallon tin containers, removing the air by a suitable vacuum pump and then infusing carbon dioxide gas in the tins and then soldered. This is known as 'Vitapack' method of gas packing of cashew kernels.

Purity of KMS and sodium benzoate

E (IS) 78

There is some old stock of potassium metabisulphite with us. We would feel highly grateful if you can suggest to us a simple and accurate method that can be followed in an ordinary laboratory attached to fruit preserving unit to find out the percentage purity of KMS. How is the amount of KMS present in a fruit product estimated? Please furnish methods for sodium benzoate as well. Which of the two preservatives is preferable for fruit products and what are the permissible limits? (Bombay).

The percentage purity of potassium metabisulphite is determined by collecting the sulphur dioxide evolved from a known weight of the preservative by its interaction with hydrochloric acid. The reaction mixture is distilled and sulphur dioxide so released is collected in known volume of N/50 iodine solution and titrating the unspent iodine solution against standard sodium thiosulphate solution using starch as indicator. 1 c.c. of N/50 iodine solution is equal to 0.64 mg. of sulphur dioxide or 1.11 mg. of potassium metabisulphite.

The estimation of potassium metabisulphite in a fruit product is carried out in the same way after preparing suitably the water extract/paste of the product. For details, kindly refer to the Official methods of analysis of the Association of Official Agricultural Chemists, 1955.

The estimation of sodium benzoate in a fruit product is done by acidification of the macerated sample with dilute hydrochloric acid and extracting the benzoic acid with chloroform in 3-4 successive

extractions. The combined extract of chloroform is evaporated to dryness at room temperature in a current of dry air. The residue is dissolved in a small quantity of neutral alcohol and water, and then titrated against N/20 NaOH. One c.c. of N/20 NaOH is equal to 0.0072 g. of anhydrous sodium benzoate.

The choice of the preservative is made carefully, *viz.*, potassium metabisulphite is used in acidic products while sodium benzoate is preferred for naturally deep coloured fruits and their products. The maximum dose of potassium metabisulphite is 1 oz. per 100 lb. of the product (350 p.p.m. of sulphur dioxide) and of sodium benzoate is 1 part for 1000 parts.

Compounded asafoetida

E (IS) 79

Could you please inform me about different varieties of pure asafoetida available on the market? What is the procedure to be adopted to prepare compounded asafoetida? (Agra).

Hing (*Ferula alliacea*) and Hingra (*Ferula foetida*) are the two varieties of asafoetida known and recognised in India. With hing a further distinction is made according to the country of origin; Irani hing from Iran, and Pathani hing from Afghanistan. In Irani hing, several varieties are recognised by trade as Irani Ras, Irani Khada, etc., while Pathani hing includes brands like Charas, Charasadda, Galmin, Hadda, Kabuli, Kharal, Shabandi, etc. These varieties are all classified mostly on the basis of the odoriferous principles. These varieties can be obtained through the usual channels from Afghanistan and Iran. In Bombay large number of merchants are importing this.

The preparation of compounded asafoetida or Bandhani Hing is done by mixing various quantities of gum and wheat flour. The gums used are gum Arabic, gum Babul, etc. These are mixed with an equal quantity of water. Pow-

dered asafoetida and wheat flour are then added and the contents well mixed. Gum Karaya is finally added before allowing the product to set. 5 parts of gum Karaya are taken for every 100 parts of the final product. During the process of setting, most of the water evaporates and the hard mass, like the marketed product, results. In general, asafoetida is prepared by using Hadda from Irani Hing which sets as a hard and dark mass. Final compounded product may contain the ingredients in the following proportions:

Irani Hing	20—25 parts
Gum Arabic	55—60 parts
Gum Karaya	5 parts
Wheat flour	5 parts

Extraction of juice from pine-apples

E (IS) 80

We are unable to extract all the juice from pineapples using a screw type juice extractor as certain quantity of the juice is always left with the pomace. Could we therefore use a hammer mill (Apex Mill) to crush the fruit and subsequently extract the juice from the crushed mass using a hydraulic press? This may help in increasing the yield of the juice. (Tripura).

It is considered unlikely that the Apex Mill will work very well in the case referred to by you. If more juice is to be extracted, it will be advisable to increase the pressure in the screw type extractor by (a) increasing the counter-weight if it has a droke system or (b) using an end plate with slightly smaller openings if it is of the meat-mincer type.

If, however, you want to procure an Apex Mill, the address is as under:

Messrs Apex Construction Ltd.,
London W. 1, England.

Infestation of sambar powder

E (IS) 81

We find that the sambar powder manufactured by us is infested by

worms and insects and does not keep well. We request you to suggest a suitable method for preventing the same without affecting the taste and smell of the powder. We are sending you a sample of the powder for examination. (Madras State).

There are only two methods of preventing the insect infestation in sambar powder or in other curry powder compositions. One method requires fumigation of the material before packing as well as that of the stacked goods and the other requires preliminary heat treatment in a dry pan before being packed into clean and dry containers. The former is a specialised technique requiring use of poisonous fumigant which can be handled by expert hands only. The latter device is simple and could therefore be advantageously adopted by you.

Separation of germs from rice and wheat brans

E (IS) 82

I shall be obliged if you could kindly send me full details of the method of separation of rice and wheat germs from the respective brans. (New Delhi).

The methods of separating the germs from the rice and wheat brans are given below:

Rice germs: The rice bran is sieved mechanically. This gives a mixture of broken rice, rice germs (embryos) and husk. This is subjected to repeated pneumatic separation when a fraction containing 95 per cent pure rice germs is obtained. Final cleaning is done by hand picking.

Wheat germs: In the wheat flour mills, the sifting equipment separates carefully the wheat bran and the wheat germs. A blast of air blown on the surface of the mixture of these two, helps in separating the heavier particles of the wheat germs (this process is called respiration).

Notes and News

STATISTICAL NOTES

All India Final Crop Estimates

Name of crop	Area (thousand hectares)		Production (thousand metric tons)	
	1959-60 (Final estimate)	1958-59 (Partially revised estimate)	1959-60 (Final estimate)	1958-59 (Partially revised estimate)
Gram	10,136	10,062	5,477	6,991
Tur	2,365	2,400	1,615	1,698
Rabi pulses (other than gram and tur)	5,175	5,258	2,733	2,805
Dry chillies	607	595	344	331

(Economic and Statistical Adviser, Ministry of Food and Agriculture, Government of India)

All India Coffee Production

Variety	Final estimate of 1958-59 crop	Revised estimate of 1959-60 crop
	in metric tons	
Arabica	26,050	30,785
Robusta	20,545	13,275
Total	46,595	44,060

(Agricultural Situation in India, June 1960)

NEWS BRIEFS

Glucono-delta-lactone: Glucono-delta-lactone has been available commercially to the food industry for over twenty years. However, until recently its use in foods has been limited to specific small quantity usage in such products as bland-flavoured sherbets, and to reduce fat absorption in waffle cones and doughnuts.

At present the U.S. Armed Forces are engaged in a developmental programme to provide a chemically leavened bread mix which will produce bread without the conventional yeast fermentation and

proofing steps. The acidulant of choice in the chemical-leavening system of this bread mix is glucono-delta-lactone.

Published reports of this work have created new interest in this acidulant, not only for the bread mix, but in many other baked products. Because of the slow hydrolysis rate of glucono-delta-lactone in cold water, little acid is formed during cake batter preparation, with a resulting small loss of carbon dioxide in this stage. The main release of carbon dioxide occurs at the elevated temperatures of the baking cycle, which is the ideal time. Also, since the acid is formed at a controlled even rate, the carbon dioxide is evolved at an even rate, producing a texture in the baked product of small, even air sacs (*Food Technol. Austr.*, May 1960, p. 283).

Synthetic protein production: A process for extracting protein from grass, leaves and other inedible vegetable matter, developed by a British chemist, Mr Israel Chayen, could prove of great benefit to the under-nourished peoples of the world. The basic aim of the process is to release, from vegetation, protein which is other-

wise indigestible because it is locked up in tough-walled plant cells.

A pilot plant for producing protein is already in operation in Britain, and it is estimated that this plant can turn out protein at a cost of less than 2d. for the average human requirement of two ounces a day. The protein extracted is in powder form, is almost odourless and tasteless and cannot go rancid. It can be added to bread, soup, stews or other foods (*Food Technol. Austr.*, May 1960, p. 283).

Flexible packages for heat processed foods: Recent experiments by the U.S. Quartermaster Food and Container Institute are aimed at developing flexible packages for military rations to withstand thermal processing as well as the metal can.

Beefsteaks and peach slices were packaged and processed, under various conditions, in most of the common plastics films and in laminates of films and aluminium foil. On the whole the films tested withstood sterilization temperatures satisfactorily and had heat penetration characteristics comparable with those of equivalent sized cans. Foil laminates proved to be more resistant to moisture and gas penetration than the unsupported films and for this reason are thought to have a greater potential for military packaging applications (*Food Technol. Austr.*, May 1960, p. 298).

A new smoke producer: A new smoke producer, applicable to the smoking of fish, designed to provide a supply of smoke which is readily controllable as regards volume, density and flavour, has made its appearance in England. It was developed by D. L. Nicol of the Humber Laboratory, Food Investigation Organization, Department of Scientific and Industrial Research, Hull, England. It is designed to fit on to existing smoking kilns, especially Torry kilns.

Mr Nicol points out that controlling the volume, density and

flavour of smoke is rather difficult with any ordinary method of burning sawdust. The new machine makes use of the fluidized bed technique. 'In effect', he says, 'we maintain a sandstorm of sawdust in a stream of hot air. This enables all the sawdust to be heated uniformly to a temperature at which it chars and produces smoke but does not actually burn. This gives a great deal of smoke from a relatively small quantity of sawdust'.

The air temperature is in the region of 300°C. (572°F.) being maintained by electric heaters with suitable automatic controls. There are arrangements for feeding in fresh sawdust and removing charred material continuously so that the machine is suitable for a plant working a continuous process.

A centrifugal fan blows the smoke produced from the machine to the kiln, and a cyclone separator prevents small particles of sawdust from being carried with it.

Mr Nicol says that the new smoke producer has taken about 4 years to develop and has just about reached the stage of reliable and satisfactory performance. It has not yet been used commercially (*Food Technol. Austr.*, May 1960, p. 299).

Packaged foods free from infestation: Highly significant to processors of packaged foods is a recent development for controlling insect infestation during all movements from plant to consumer. Employed is a repellent dust containing a small amount of insecticide. It's added to filled shipping containers just before the sealing operation. Any subsequent handling distributes it throughout the interior of the case and on the walls of the packages themselves.

Processors of such foods as macaroni, noodles, cereals, prepared mixes, candy, dates, and other packaged foods, receive numerous complaints that their goods are infested. Naturally, the broker or warehouseman insists on returning these infested packages with contaminated materials. And, in the

interest of good customer relations, the processors much accommodate them. The product is either destroyed or diverted to animal feed resulting in large losses.

With this system, the repellent never touches the product, since it is dumped only into cases containing packaged foods. The pyrethrin insecticide used is among the safest to mankind and can be generally considered innocuous. And since only a tiny portion of this dust is insecticidal, danger of contamination or toxicity is remote (*Food Technol. Aust.*, May 1960, p. 300).

Lye coating-pressure steam cuts potato peeling losses: Peeling potatoes and other root crops by precoating with hot caustic solution, then subjecting them to atmospheric steam under pressure results in smaller product losses than either straight lye or steam-peeling.

Comparisons were made between the three methods. In straight lye peeling, various caustic strengths, temperatures and exposure times were tried. This was also done with the combination method. In addition, different steam pressures and exposure times were tried with this method.

Best results were obtained by immersing potatoes 5 min. in 5 per cent lye solution, then exposing them for 30 sec. to 90 psi. steam. Peel loss by this method was 12.3 per cent compared with 18.6 per cent for steam and 22.4 per cent for lye (*Food Engng.*, April 1960, p. 105).

Preparation and uses of frappes in candies: Foamy masses used in marshmallows, nougats, light toffees, and similar articles may be divided into: (1) whips (up to 55 per cent solids, density 0.20, stable for only a few minutes); (2) one-day frappe (65-75 per cent solids, density 0.35, stable for about 8 hr.) and (3) standard frappe (over 80 per cent solids, density 0.50, stable for a week or more).

Egg albumen and other whipping agents provide foaminess, sugar

the extra solids. Both density and stability go up with solids. Both whips and frappes can be blended with other ingredients to make final candy batch.

In final mixture: (1) Decreasing water content causes loss of air and increases density; (2) high solids, high density frappe leads to less loss of volume and a lighter batch; (3) low water and long mixing leads to higher density and (4) fat additions increase density.

Frappe of minimum density is obtained by beating with air under pressures up to 45 psi. Time of preparation is also reduced by pressure method. Both continuous and non-continuous beaters are available. Former with capacities to 7000 kg./8 hr., latter 500-2,000 kg. (*Food Engng.*, April 1960, p. 106).

Prepackaging treatments help fruit keep longer: Dipping fruits in chemical solutions before packaging shows promise of extending their shelf lives considerably.

In experiments at Utah State U. firm ripe strawberries and Bing cherries were dipped in solutions of various chemicals, air dried, put in sterile plastic baskets, which were placed in poly bags and stored at 41°F. Strawberries were kept 1 month, cherries 1½ months.

With strawberries, Captan (Calif. Spray Chem. Corp.), DHA-S and Dowcide A (Dow Chemical Co.), all at concentrations of 1,000 ppm, showed significant fungicidal effects and, also, maintained colour. Potassium sorbate (1,000 ppm), DHA-S, Dowcide-A (1,000 ppm.), and Myprozine (100 ppm, Amer. Cyanamid) retarded mold growth in cherries (*Food Engng.*, May 1960, p. 86).

Preservation of honey: Honey can be stopped from crystallizing or caking in a jar by adding fatty acids to it, according to Dr Kalo-yereas of Louisiana State University. He has received a patent on his honey treatment which he expects will save the honey industry millions of dollars. In the old days, honey experts fought off crystallization by heating the honey, but this was

not ideal. The heating often caused discolouring and destroyed vitamins, aroma and enzymes. Dr Kaloyereas has also found that bees can be influenced to produce honey that does not crystallize. He has showed that bees can be fed a sugar solution containing the fatty acids, and that crystals will not form in the honey they deposit (*J. & Proc. Inst. Chem.*, May 1960, p. 151).

Instant mashed potato flakes: A new plant, first of its kind in Canada, has been opened for the production of instant mashed potato flakes. A 'high solids' type of potato is used for the purpose and the selected material is stored in a conditioning room to bring it to the ideal state of temperature and humidity of processing. The method of processing consists in washing the potatoes, steam-peeling, trimming, slicing to about $\frac{1}{2}$ inch thickness and then pre-cooking for 20 min. in water at 160°F. The slices are later cooked in atmospheric steam until sufficiently soft, the time taken for this being 20 min. for high solids types and 40 min. for low solids varieties. Over cooking is avoided as it affects the texture. The cooked potato slices are mashed in a ricing machine, the description of which is given. The mashed potatoes, with added additives if desired, are dried in a large single drum drier, which can process 8000 lb. of mashed material into flakes every hour. The dense sheets, removed from the drier with the help of a blade, are passed through a slitting roll followed by a roll which cuts the strips transversely to get thin $\frac{1}{2}$ inch flakes. The flakes are packed in air-tight packages.

It is claimed that the above process retains the natural characteristics of the potatoes to a greater degree than any other method, saves peeling and mashing time, and eliminates waste (Abstracted from *Food Manuf.*, June 1960, p. 255).

DRAFT INDIAN STANDARDS

Infant foods: The infant foods at present in use in the country

can be divided into three categories: (a) infant milk foods, (b) processed cereal infant foods and (c) special infant foods. An Indian Standard Specification for Infant Milk Foods has already been finalized. The remaining categories have now been covered by two draft specifications.

The first draft covers cereal foods intended for feeding infants at the weaning stage, either wholly or as a partial substitute for infant milk foods or for mother's milk; second draft deals with foods intended for general feeding of infants and for feeding infants in special cases (*ISI Bull.*, May-June 1960, p. 156).

NEW INDIAN STANDARDS

Glass containers for preserved fruits industry: Glass containers of varying qualities, sizes and shapes are being used at present by the preserved fruits industry. Often, controversial opinion has been expressed by consumers and manufacturers about the performance of the containers manufactured in the country. In view of the considerable expansion of this industry during recent years and the consequent increase in the demand for containers, their standardization was felt important to ensure a regular supply of suitable quality of glass containers. Consequently ISI has published the Indian Standard Specification for Glass Containers for Preserved Fruits Industry (IS: 1494-1959). This standard prescribes the methods of test and requirements regarding quality of glass, workmanship, limit of alkalinity and thermal shock test for the glass containers (*ISI Bull.*, July-August 1960, p. 207).

Lactose: Lactose is manufactured from whey remaining after the manufacture of casein, cheese or *chhana* from milk. It is used in dietary foods and in pharmaceutical products. It has been found especially useful in penicillin production as a constituent of the fermentation medium. The Indian Standard Specification for Lactose, Commer-

cial (IS: 1000-1959) prescribes requirements and methods of test for commercial lactose. It does not cover lactose used for pharmaceutical purposes (*ISI Bull.*, July-August 1960, p. 208).

White bread: The Indian Standard Specification for White Bread (IS: 1483-1959) prescribes requirements and methods of test for white bread. It does not include brown bread, fancy bread, fruit bread rolls and chemically aerated bread.

The following metric weights and tolerances of white bread have been specified:

- (1) $100 \pm 5g$. (2) $200.0 \pm 7.5g$.
(3) $400 \pm 10g$. and (4) $800 \pm 15g$.

However, provision has also been made for the industry to continue making loaves of the following weights till the industry is ready to enforce rationalized weights given above:

- (1) $115 \pm 5g$. (2) $225.0 \pm 7.5g$.
(3) $450 \pm 10g$. and (4) $900 \pm 20g$.

(*ISI Bull.*, July-August 1960, p. 208).

INDIAN PATENTS

(A few of the Patent Applications notified as accepted in Part III, Section 2 of the Gazette of India, June 4—July 30, 1960 are given below.)

67478. Improved tea extracts and process for making the same: Comprises heating an aqueous extract of green tea with enzymes contained in freshly harvested tea leaves, in the presence of oxygen.—Patented by Unilever Limited.

68557. Multiple effect vacuum evaporator: Wherein a vapour condensing member is positioned in the final stage separating vessel and has vapour scrubbing system.—Patented by S. Sumiya.

70788. Process for the production of a device for combating insects, in particular, flies: Giving dark red colour to sheets of porous materials containing a substance which is soluble in water and

toxic to insects.—Patented by J. R. Geigy A.-G.

65100. *Improvements relating to food carriers:* Characterized in that each of the straps as well as the knol of the cover of the topmost receptacle is provided with a hold and slot combination.—Patented by C. A. Avindyanmanik and Lakhi Trading Company.

66693. *Improvements in pulverizing mills:* Having an annular grinding zone provided by an upper rotary grinding ring and a lower non-rotary grinding ring and a circular row of grinding balls between the rings.—Patented by Babcock and Wilcox Limited.

67658. *Improvements in or relating to trolleys for use in the processing of tea leaf:* Tray supporting brackets set at an angle of between 10° and 30° to the horizontal.—Patented by J. J. R. Simpson.

66952. *Process for making dispersible vegetable gums:* By treating finely divided gum particles with an aqueous solution which hydrates the gum particles at a rate not in excess of 50 per cent of the rate at which water hydrates said gum.—Patented by General Mills, Inc.

67007. *Improvements in and relating to container for preserving food materials:* Provided with grooves at the top surface where crown corks are fitted to prevent slipping of the cork.—Patented by M. A. Chaudary.

67324. *Continuously operating tea withering, fermenting and oiling machine:* Comprising a chamber closed except its two ends, a pair of endless chains one at each side of said chamber and a plurality of trays spacedly located between said chains.—Patented by The Chairman, Indian Tea Association.

67839. *Coffee making machine with a continuous circulation of hot water in the heads:* Head-fastened direct to the frame of machine whilst circulation chamber is in communication at the top with water space of boiler by a draw-off pipe at normal level, and at the bottom by a return pipe at minimum

permissible level.—Patented by E. Valante.

67840. *Improvements in or relating to apparatus for making a coffee beverage:* Comprising container receiving coffee from filter housing which is fitted with filter holding ground coffee and connected to recessed member communication through a valve with water, chamber of boiler, the container being associated with another recessed member defining a space communicating with steam chamber of boiler to heat the container.—Patented by E. Valante.

66382. *Edible formulations and process of preparing the same:* Edible formulations containing arabitol.—Patented by The Distillers Company, Limited.

66640. *Process for producing L-glutamic acid by fermentation using micro-organism:* Inoculating the spores of micro-organism, *Bacillus megatherium* or *circulans* to medium of saccharide liquor, cultivating aerobically.—Patented by Ajinomoto Kareshiki Kaisha.

67404. *Process of obtaining the proteinaceous feed material from mustard seed, rape seed and similar seeds:* Treating mustard and rape seeds after oil extraction with water and raising the temperature to 45°-55°C, maintaining the mixture at this temperature for sufficient time to produce complete hydrolysis of thioglucosides, removing sulphur-containing compounds by steam stripping, and then screening, pressing and drying.—Patented by Oil Seed Products, Inc.

67416. *A process of chemical treatment of paddy to replace parboiling of paddy:* Treating with aqueous solution of urea or alkali-thiocyanate or mixture thereof.—Patented by Chairman, Khadi & Village Industries Commission.

68753. *Improvements in tea rolling apparatus:* Comprising two plates having a roughened surface arranged with their roughened surfaces facing one another and a small gap between them; means for imparting an eccentric motion to one of the plates and means for

feeding the leaves continuously into the space.—Patented by Marshall's Tea Machinery Company Limited.

FOREIGN PATENTS

826,711. *Shelling shrimps:* The known method of shelling shrimps according to which boiled shrimps are dried to cause the shell to become brittle and enable it to be easily removed, and the highly dried flesh again hydrated with water, results in loss of quality due to the long drying process causing the flesh to lose too much cell water which is only replaced insufficiently and with loss of quality by soaking in water. Prior to drying and subsequent removal of the shell from the flesh by grating, sieving, use of water jet, etc., the shells of the boiled shrimp are first partly cut away or perforated by being conveyed between a pair of rollers and supported in a radially resilient manner—in this way the water of the shell, which is not cell-bound water, is rapidly removed in the subsequent drying so that the parts of the shell which have been severed or perforated very rapidly become brittle without any substantial amount of the cell water in the flesh being lost and a short drying period only is necessary to effect a simple sieving of the shells.—Patented by Wolfgang Henning (*Food Trade Rev.*, April 1960, p. 88).

827,823. *Can bodies:* Relates to a seaming mechanism for securing ends on can bodies, of the kind in which the body and the end are held stationary whilst seaming rolls are rotated above the body; it is particularly applicable to cans having a cross-section other than circular.—Patented by the Metal Box Co. Ltd. (*Food Trade Rev.*, April 1960, p. 90).

2,929,717. *Dehydration of coffee extract:* In the dehydration of a coffee extract, Roderick K. Eskew passes a high solids concentrate through a preheater into a vacuum down-flow film type evaporator wherein the feed rate, temperature, and vacuum are so regulated

that the product emerges as a molten liquid. This liquid is cooled, and the resulting brittle solid is ground to a powder. If desired, a sugar may be added to the molten extract before cooling.—Patented by U. S. Secretary of Agriculture (*Coff. & Tea Ind.*, July 1960, p. 56).

2,933,395. *Improved decaffeinated soluble coffee extract:* In the preparation of an improved decaffeinated soluble coffee extract, Irwin L. Adler and Earnest L. Earle flow the extract in a thin film while subjecting it to evaporation temperature and pressure to strip the volatile flavour and aroma constituents therefrom. These constituents are condensed and collected. The stripped extract is contacted with water-immiscible organic solvent to remove the caffeine. The decaffeinated product is separated from the caffeine-laden solvent and recombined with the volatile flavour and aroma constituents.—Patented by General Foods Corp. (*Coff. & Tea Ind.*, July 1960, p. 56).

592,211. *Preparation of a solid tea essence:* In the preparation of a solid tea essence or tea essence concentrate which produces a clear iced beverage, the ordinarily cold water insoluble fraction is rendered cold water soluble by treating the tea at elevated temperature with sodium sulfite or other systematically innocuous water-soluble sulfite. Inventor Irving I. Herz shows examples of the treatment of orange pekoe tea containing a high proportion of water insolubles, e.g., 43 per cent of the total of originally dissolved solids.—Patented by Afico S.A. (*Coff. & Tea Ind.*, July 1960, p. 57).

596,135. *Preparation of a pure soluble tea extract:* In the preparation of a pure soluble tea extract in powder form, Donald Wetherilt extracts the leaves with hot water, separates the volatile aromatic substances with steam, and condenses these components. The steam-stripped extract is concentrated,

and the concentrate mixed with desired amounts of the condensed aromatic fraction, and the mixture spray dried.—Patented by Inredeco Inc. (*Coff. & Tea Ind.*, July 1960, p. 57).

2,910,365. *Low methyl pectin:* Composition can be cold-mixed with milk to make jelly.—Patented by M. Olliver, Chivers & Sons, Cambridge, England (*Food Engng.*, April 1960, p. 148).

2,911,302. *Egg instant coffee:* By mixing shelled whole eggs with roasted coffee and water, heating, adding roasted coffee extract to filtrate, drying.—Patented by F. A. Chase, Morris Plains, N. J. (*Food Engng.*, April 1960, p. 148).

2,903,372. *Clarifying grape juice:* By cooling, treating with sound waves to agglomerate argols and crystallize tartrates, then removing same juice.—Patented by L. H. Walker, Berkeley, California (*Food Engng.*, April 1960, p. 148).

811,798. *Citrus fruit concentrate:* A citrus fruit juice concentrate of improved stability is obtained by removing the flavedo layer from citrus fruit, submitting the fruit (containing the albedo layer and tissue enclosing the juice substantially intact) to enough pressure to rupture it and to remove the juice without crushing the seed; separately compressing the albedo and juice cell tissue to remove the albedo juice; adding the latter (1-5 per cent) to the fruit juice; and (before or after said addition) removing water from the fruit juice in successive freeze dehydration stages (at 5°F).—Patented by Union Carbide Corp. (*J. Sci. Fd. Agric.*, July 1960, p. ii. 34).

811,545. *Isolation of caramel colour:* A caramelised carbohydrate solution, which contains substances inhibiting fermentation of sugars, is distilled (with addition of more water if necessary) to remove such substances and the remainder inoculated with an organism or enzyme which can ferment sugars

present. Caramel colour bodies are present in the solution and can be isolated in relatively pure form.—Patented by Union Starch and Refining Co. Inc. (*J. Sci. Fd. Agric.*, July 1960, p. ii. 42).

810,218. *Dried edible products:* A process for the preparation of dehydrated foodstuff (e.g. carrots) in the form of dice or small flakes, comprises admixing the foodstuff (in discrete pieces) with enough dried powdered food substance (e.g. cooked mashed potato powder) to absorb the surface moisture of the former without losing powdery consistency, then drying the pieces by evaporation (whilst mixed with or after separation from the powdered foodstuff).—Patented by R. A. S. Templeton. (*J. Sci. Fd. Agric.*, July 1960, p. ii. 43).

BOOK REVIEW

Preservation of fruits and vegetables, by Girdhari Lal, G. S. Siddappa and G. L. Tandon (pp. 358), published by the Indian Council of Agricultural Research, New Delhi, 1960, Price: Rs. 11.50.

This book is the first comprehensive publication in India dealing with the important subject of fruit and vegetable preservation and embodies results of researches conducted at the Central Food Technological Research Institute, Mysore and the former Indian Institute of Fruit Technology, Lyallpur on various scientific methods of preparing fruit juices, squashes, jams, jellies, marmalades, pickles, etc., canning and bottling, and drying and dehydration of fruits and vegetables, etc.

The publication is very useful for the Fruit and Vegetable Preservation Industry, Extension Workers, Home Science Colleges and others interested in the utilization of seasonal gluts of fruits and vegetables particularly under the existing limitations of adequate transport facilities for these perishables.

R.C.B.

Information from Foreign Journals

THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

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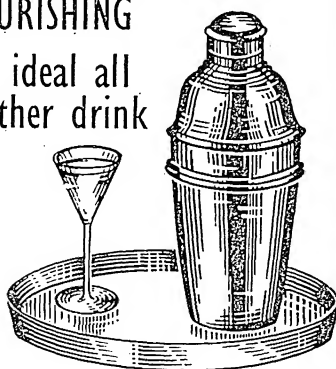
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Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Effect of garlic on the growth of yeasts and moulds, by Sreenivasamurthy, V., Sreekantiah, K. R. and Johar, D. S., *J. sci. industr. Res.*, 1960, 19C (2), 61.—Although garlic is extensively used in treating several disorders, the exact mechanism of its action is not clearly known. The medicinal action is believed to be partly due to its antibacterial and antifungal property. The AA have studied here the effect of different concentrations of garlic extract on the viability of mould spores and yeast cells and on the growth of yeasts and moulds using *Aspergillus niger*, *Penicillium notatum* and *Torula utilis* as test organisms. Garlic extract is prepared by macerating surface-sterilized (with alcohol) garlic cloves in sterile distilled water. The results show that the growth of the moulds was inhibited with 0.6 per cent garlic extract while with lower concentration, the sporulation was only delayed. The mycelial weights were, however, more than that of the controls. Spores of *A. niger* remain viable up to 12 hours in mediums containing different concentrations of garlic extract. After 12 hours, only spores suspended in 0.6 and 1.0 per cent levels are inactivated and in 10 per cent garlic extract, the viability remains up to 6 hours. Garlic extract also inhibits the growth of yeasts, viz., *Torula utilis* and the yeast cells remain viable up to 12 hours in mediums containing more than 0.2 per cent garlic extract. The results of the present study indicate that garlic acts as a fungistatic agent at lower concentrations while at higher concentration, it acts as a fungicidal agent. K.L.R.

Studies on equilibrium relative humidity (E.R.H.) for passion

fruit juice powder, by Pruthi, J. S., Ramu, S. D. V. and Girdhari Lal, *Sci. & Cult.*, 1960, 25, 489.—Passion fruit juice powder was exposed to ten different levels of relative humidity ranging from 5 to 91 per cent at 30°C. The time taken by the powder to reach moisture equilibrium at each level of relative humidity was determined by taking the gain or loss in weight at varying intervals. Changes occurring in the powder with regard to texture, caking and colour were noted and the critical and danger points determined. Colour changes were evaluated by taking tintometer readings directly on the powder and also by measuring per cent light absorption by 2 per cent aqueous solution of the powder at different moisture levels. It is seen from the results that passion fruit powder is highly hygroscopic, picking up moisture even at 10 per cent relative humidity. The E. R. H. at 30°C for the powder with 3 per cent moisture is about 6 per cent. The critical point regarding caking is about 6 per cent moisture level and the danger point about 5.5 per cent level when granulation is noticed. Mould attack was visible only at higher relative humidities. The colour of the powder was affected only after a moisture level of 9.0 per cent. Maximum retention of colour and flavour was found in the case of passion fruit powder with 3 per cent moisture or less. K.L.R.

Chemical composition, keeping quality and nutritive value of safflower and niger seed oils, by Narayana Rao, M., et al., *Bull. Nat. Inst. Sci. India*, 1960, 15, 115.—One variety each of safflower seed and niger seed were examined with respect to chemical composition

of the seed, kernel and oil. The stability of crude, refined and bleached safflower seed and niger seed oils was studied both by the A.O.M. test as well as by storing in aluminium and tinned brass containers for a period of three months and following the rate of development of peroxides. The results indicate that safflower seed and niger seed oils are easily susceptible to oxidative rancidity and are not as stable as groundnut oil. No significant difference between the growth promoting value of safflower seed oil, niger seed oil, groundnut oil and cow's ghee was observed. Safflower seed and niger seed oils were found to be almost completely digestible (to the extent of 95-98 per cent) by rat. In the case of young rats fed on an adequate diet containing safflower or niger seed oils at 10 per cent level the retention of nitrogen was about 51 per cent, of calcium 60-62 per cent and of phosphorus 66-67 per cent.

Effect of grading and some pretreatments on the quality of deep fat-fried beans (*Dolichos lablab*), by Bhatia, B. S., Prabhakar, J. V. and Girdhari Lal, *Indian J. agric. Sci.*, 1960, 30 (1), 48.—Effect of grading and some pretreatments like blanching, pre-cooking and steeping in solutions of sodium chloride, potassium metabisulphite and citric acid on the quality of deep fat fried field beans has been studied. The results show that (a) field beans used for deep fat frying can be graded for maturity by floatation in six and nine per cent brines (w/w) which separate tender, partially mature and mature beans; (b) it is not considered possible to correlate maturity of beans with the proximate com-

position; (c) fried product from partially mature beans is good, but mature beans give the best product; (d) blanching in one per cent sodium bicarbonate or sodium hexametaphosphate for four minutes is the best method of removing cuticle, which helps to reduce spurting losses, eliminates danger to the operator, reduces frying time and gives a uniform colour to the fried product; (e) loss of nutrients during blanching of field beans, though quite high (six per cent proteins, 40 per cent salt soluble proteins, 28 per cent ether extract and 16 per cent minerals), is considered of the same order as in canning and dehydration; (f) removal of cuticle reduces fat loss by about eight per cent in the field beans; (g) treatment with sodium chloride, calcium chloride, citric acid, or sulphur dioxide has not been found to improve the quality of the fried product; and (h) cooking of beans before frying increases the fat uptake and results in a fried product of inferior quality.

The effect of feeding diets containing insect-infested jowar on the growth and composition of blood and liver of albino rats, by Venkat Rao, S., *et al.*, *Ann. Biochem. exptl. Med.*, 1960, 20 (5), 135.—The effects of feeding a poor vegetarian diet containing insect-free and insect-infested jowar and Bengal gram on the growth and structure and composition of the liver of rats have been investigated. The mean gain in weight of rats on the uninfested jowar diet was slightly greater than that observed on the infested jowar diet. The average fat content of the livers of rats fed on the infested jowar diet was significantly higher than that of the livers of rats maintained on the uninfested jowar diet.

Histological examination of the livers of rats fed for 6 months on the infested jowar diet showed different degrees of centrilobular fatty infiltration. On the other hand, the livers of rats fed for a similar period on the uninfested jowar diet and the same diet supplemented with uric acid

(equivalent to that present in the infested jowar diet) did not show any fatty change.

Analysis of piperine by spectrophotometric method. Part I, by Ramachandra Rao, T. N., Dwarkanath, C. T. and Johar, D. S., *J. & Proc. Inst. Chem.*, 1960, 32 (3), 125.—Piperine, the bite factor present in pepper, is estimated either by the A.O.A.C. method based on the determination of total nitrogen or by the spectrophotometric method based on the absorption maximum at 345 m μ . The present paper deals with the comparative study of the two methods. The percentage of piperine in the original material and the oleoresin of ten different varieties, four trade grades of export importance and three trade wastes of pepper determined according to the two methods are given. Results show that piperine values obtained by the spectrophotometric method are lower as compared to the crude piperine values by the nitrogen method. The higher values in the latter method may be due to the presence of other nitrogenous substances. This comparative study reveals that the spectrophotometric method is simple and more accurate than the nitrogen estimation method. It is also specific as other nitrogenous substances present do not interfere with the true values for piperine.

K.L.R.

Composition of Indian mango chutney, by Tandon, G. L., Girdhari Lal and Sripathy, N. V., *Indian Food Packer*, 1960, 14 (5), 6.—Nearly 80 per cent of the mango chutney produced in India is exported. Sixtyone samples of mango chutney have been analysed with a view to assessing the quality, determining to what extent they conform to the standards of U.K. importers and suggesting new specifications. The maximum, minimum and average values of the analysis for fruit slices, soluble solids, volatile and total acidity, sugars, protein, sodium chloride, total and acid insoluble ash, moulds, yeasts and bacteria are given.

Comparison of the results with the F.P.O. (1955) specifications and the U.K. Importers' specifications shows that 93.5 per cent of the samples examined conform to the former while only 11.5 per cent conforms to the latter. All the samples were free from any added preservative and artificial colouring matter. Wide variation in the composition of the samples has an adverse effect on the export. If the Indian mango chutney industry should develop on right lines, maximum and minimum permissible limits have to be laid down in the Fruit Products Order for each ingredient. The AA have suggested new specifications for fruit chutney.

K.L.R.

Crude fibre content as an index of adulteration in tomato ketchup, by Siddappa, G. S. and Beerh, O. P., *J. sci. industr. Res.*, 1960, 19C (5), 129.—This note deals with the application of crude fibre content as an index for detecting adulteration of tomato ketchup. The crude fibre content and the total solids of genuine as well as adulterated samples of ketchup containing 25 per cent of added pulps of carrot, ash gourd, pumpkin, sweet potato, papaya and apple pomace are given. It is found that the crude fibre content of genuine ketchup (1.45 per cent) is considerably increased (1.79-1.84) as a result of adulteration with other pulps due to the fact that all the adulterants used have higher crude fibre values than ripe tomatoes. Only in the case of ketchup adulterated with sweet potato, the fibre value is about the same. The presence of sweet potato can, however, be detected by chromatographic identification of sugars in the ketchup as reported earlier by the AA. The crude fibre content can, therefore, serve as a useful index in detecting adulteration particularly when supplemented by other methods based on lycopene and β -carotene contents.

K.L.R.

PART II (Indian)

ANALYTICAL

Paper chromatographic analysis of acids (Horizontal migration method): Part VII, by Mohan Rao, V. K., *J. sci. industr. Res.*, 1960, 19B (7), 265.—The circular R_f values of inorganic anions, *viz.*, arsenate, chromate, ferricyanide, ferrocyanide, halides, oxy-halides, nitrate, sulphate and thiocyanate have been determined in six solvents, namely, *n*-butanol-ammonia, *n*-butanol-pyridine-water-ammonia, ethanol-ammonia-water, 2, 6-lutidine-water, collidine-water and *n*-propanol-ammonia; the last three solvents have been used for the first time in the chromatography of inorganic anions. The amount of water present in 2, 6-lutidine influences the R_f value and 70 per cent aqueous lutidine has been found to give satisfactory results. Collidine saturated with water is useful in the separation of oxy-halides. The effect of varying pH on the R_f values of chloride and nitrate ions is not significant. The study of the chromatographic behaviour of various chloride salts has shown that the presence of ammonium and lithium cations increases the R value of chloride ion relative to that of sodium or potassium ions.

Quantitative estimation of carbohydrates by paper partition chromatography, by Misra, S. B. and Mohan Rao, V. K., *J. sci. industr. Res.*, 1960, 19C (7), 173.—A simple micromethod for the quantitative estimation of aniline hydrogen phthalate (AHP) stained sugar spots has been standardized. Of the solvents examined for their effective elutability, besides formamide, the following are found suitable within 50-80 per cent concentration range: acetic acid, methanol, ethanol and acetone. The various factors that affect the accuracy and reproducibility of results in this method have been critically examined. As a result of the analysis of some sugar mixtures, using three different solvent systems,

it is found that the overall error does not exceed ± 6 per cent.

BIOCHEMISTRY AND NUTRITION

Effect of safflowerseed oil and cholesterol on serum and tissue lipids in rats, by Patil, V. S. and Magar, N. G., *Indian J. med. Res.*, 1960, 48 (5), 623.—The effect of feeding 20 per cent safflowerseed oil and cholesterol on the tissue and serum cholesterol, phospholipids and poly-unsaturated fatty acids is reported in this paper. Albino rats, maintained on a fat-free diet for a week, were fed a diet consisting of 20 per cent safflowerseed oil, 22 per cent casein, 4 per cent salt mixture and 54 per cent sucrose and sufficient quantity of vitamins. The iodine value and linoleic acid content of the *ghani*-pressed oil were 140 and 63 per cent respectively. 0.5 g. of cholesterol was given to one group of rats after 6 weeks of feeding. The tissues, liver, kidney, heart, brain and serum were analysed after a feeding period of eight and half months. The amounts of total and poly-unsaturated fatty acids; free, ester and total cholesterol; and total phospholipids present in the tissues and serum of the rats fed safflowerseed oil with or without cholesterol are given. The percentages of di-, tri-, tetra-, penta- and hexaenoic fatty acids have also been determined and the results have been discussed in the light of earlier reports. It is found that diet containing 20 per cent safflowerseed oil and cholesterol causes an increase in total and ester cholesterol and cholesterol to phospholipid ratio of tissues and serum of rats while the total phospholipids in the serum decrease. The percentages of dienoic, tetraenoic and pentaenoic acid on total fatty acids are lower and the total fatty acid higher in tissues and serum of animals fed oil with cholesterol than those of animals fed only the oil. K.L.R.

Xanthine oxidase and alkaline phosphatase activity in the breast milk of poor Indian women, by Bhavani Belavady, *Indian J. med. Res.*, 1960, 48 (5), 654.—Samples of milk from 137 mothers have been analysed for xanthine oxidase activity, alkaline phosphatase activity and the related nutrients. Both xanthine oxidase activity and phosphatase activity decreased after the first month of lactation. Xanthine oxidase activity had a direct correlation with the protein content and no correlation with the riboflavin content of milk. Alkaline phosphatase activity had a direct correlation with the protein content and the ratio of free to total thiamine in milk.

Mode of action of vitamin D. Experiments with low calcium rickets, by Krishna Rao, G. V. G. and Patwardhan, V. N., *Indian J. med. Res.*, 1960, 48 (5), 661.—Influence of vitamin D on citrate, calcium and inorganic phosphorus in serum and citrate and citrogenase activity in cartilage in low calcium rickets has been studied. Serum calcium, cartilage citrate and citrogenase activity were low in low calcium rickets and rose to higher levels on treatment with vitamin D. Serum citrate in low calcium rickets was not significantly different from that of protected animals. Administration of vitamin D brought about a sharp fall at 48 hours after treatment followed by a rise. The significance of these findings in low calcium rickets in relation to those reported in low phosphorus rickets is discussed. It is concluded that the primary biochemical lesion in vitamin D deficiency at the site of calcification consists in the breakdown of processes leading to the local formation of citrate.

A study on urease from *Cajanus cajan* Linn. Millsp. Part III: Crystallization, by Nath, R. L. and Pradhan, T. K., *Ann. Biochem. exptl. Med.*, 1960, 20 (5), 127.—Urease from *Cajanus cajan* has been crystallized by using 40 per

cent ethanol as the solvent. Lower members of the primary monohydric alcohols have no inactivating effect on this urease. Preparations obtained with acetone are practically white and contain more of the water-soluble matter than those obtained with alcohol. Urease from *Cajanus cajan* is specific for urea.

Kwashiorkor in Hyderabad and Coonoor: A comparison of salient features, by Venkatachalam, P. S. and Gopalan, C., *Indian J. med. Res.*, 1960, 48 (5).—The AA have given some salient clinical features of 107 cases of *kwashiorkor* investigated by them in a period of 8 months in Hyderabad and compared them with those examined by them before in Coonoor. All the patients belonged to the low socio-economic group. While, in Coonoor, rice was the main cereal, in Hyderabad *jowar* (*Sorghum vulgare*) with rice constituted the diets of the cases investigated. Significance of some of the regional variations in the clinical picture has been discussed. It would appear that the cases of *kwashiorkor* observed in Hyderabad were more severe than those in Coonoor.

B.V.S.

ENZYME

Preparation of ubiquinone (coenzyme Q) from rice bran, by Krishna Murthi, C. R. and Vijay Varma, *J. sci. industr. Res.*, 1960, 19C (7), 180.—Ubiquinone has been isolated from the lipid-soluble concentrates of the rice bran, in a yield of 40 mg./100 g. of the rice bran concentrates. The identity of ubiquinone has been confirmed through the study of its ultraviolet absorption spectra as well as the spectra of the potassium borohydride reduced product.

MICROBIOLOGY

Nutritional requirement of *Lactobacillus leichmannii*, by Gupta, Y. P. and Das, N. B., *Ann. Biochem. exptl. Med.*, 1960, 20 (5), 119.—The minimum nutritional

requirement of *Lactobacillus leichmannii* and the presence of certain factor or factors in tomato juice which stimulate the growth of this organism have been reported. The amino-acids arginine, tryptophan, valine, glutamic acid, threonine, histidine, leucine, serine, phenylalanine, cystine, aspartic acid, lysine, tyrosine, *iso*-leucine and alanine, as well as calcium pantothenate, niacin, folic acid, guanine and uracil are necessary for adequate growth of the organism. The requirement of lysine, serine, tyrosine and *iso*-leucine as well as that of folic acid, guanine and uracil is only partial.

Pyridoxal or pyridoxamine phosphate can replace DL-alanine. The requirement of pyridoxal is eliminated if D-alanine is present in the medium. In an otherwise complete medium containing L-alanine but no vitamin B₆, D-alanine is essential for the growth of this organism.

Tomato juice, liver extract, meat extract, Difco peptone, Difco yeast extract and potato extract contain certain factor or factors which stimulate the growth of this organism.

Some characteristic properties of the stimulating factor or factors present in tomato juice have been studied. A part of the stimulating factor is dialysable and part non-dialysable. Part of the factor is soluble in ether. The factors are stable to heat and hydrogen peroxide. It is destroyed by acid hydrolysis with the release of a number of amino-acids, suggesting thereby that at least a part of the factor is peptide in nature.

Influence of *Aspergillus niger* and *Penicillium notatum* on cottonseed oil, by Waheed Khan, A. and Chughtai, I. D., *Curr. Sci.*, 1960, 29 (3), 100.—Cottonseed oil is used as the substrate for cultivating *Aspergillus niger* and *Penicillium notatum* and the nature of changes caused by the moulds on the physico-chemical characteristics of the oil is reported. The strains were first cultivated in appropriate basal

media containing 10 per cent (v/v) of cottonseed oil. After the incubation period, the residual oil was separated by extraction with petroleum ether, passing through a column of anhydrous sodium sulphate and evaporating the ether at room temperature. The oil was analysed for melting point, acid value, iodine value, thiocyanogen value, degree of rancidity and fatty acid composition. The results are compared with the initial values for the oil. It is found that *A. niger* mainly attacks oleic acid while *P. notatum* attacks both oleic and linoleic acids decomposing them to free acids. This is also indicated by the progressive rise in acid value. The rancidity of the oil first increases and then falls down probably due to the formation of ketones which are removed or broken down in the later stages of fermentation. Similarly, there is an appreciable rise in the melting point of the resultant oils.

K.L.R.

GENERAL

Constitution of mangiferin, by Ramanathan, J. D. and Seshadri, T. R., *Curr. Sci.*, 1960, 29 (4), 131.—Mangiferin, a crystalline compound, can be isolated from the leaf and bark of mango tree, from unripe mango, and from the heartwood, the highest yield (2.5 per cent) being from the bark. The AA have studied the configuration of mangiferin. It is a xanthone derivative. Experiments carried out on the preparation of derivatives of mangiferin, characteristics of the two methyl esters, hydrolysis of the glucoside, etc., show that the sugar present in mangiferin is probably glucose which is directly linked to a nuclear carbon atom. This carbon atom is most likely to be in the 2-position of the xanthone nucleus. An earlier report, however, indicated that mangiferin is the glucoside of 1:3:6:7-tetrahydroxy xanthone with the sugar molecule linked in the 7-position.

K.L.R.

PART III (Foreign)

ANALYTICAL

The estimation of residual solvents in spice oleoresins, by Paul H. Todd, Jr., *Food Technol.* 1960, 14 (6), 301.—The food additives amendment of 1958 to the Federal Food, Drug and Cosmetic Law establishes the requirement of tolerance levels for potentially harmful food additives. In manufacturing spice oleoresins, a number of solvents are employed, and some of them will no doubt come under the purview of the law. It is important, therefore, for users of oleoresins to have a simple and reasonably accurate technique for determining the presence and amounts of commonly employed solvents. This paper reports a technique for evaluating residual solvents at levels below 50 ppm with accuracy of within ± 12 ppm. Results are reported using methylene chloride, ethylene dichloride, trichloroethylene hexane, methanol, isopropanol, and acetone, although the principle can be extended to any solvent. Each solvent was studied individually, and then used in combination. The general method employed involves adding an internal standard of benzene diluted in toluene to a 50 g. sample of the oleoresin and distilling the toluene into a Clevenger trap. The benzene is present in a known concentration in the oleoresin, and the levels of the other solvents are then related to it by making a gas chromatographic analysis of the distillate. The technique reported meets the following criteria: (1) The method is simple and requires little operator time. (2) A minimal sample size can be used. (3) Results are fairly consistent and reliable at the levels required.

Use of gas chromatography in measuring the ethylene production of stored apples, by Meigh, D. F., *J. Sci. Fd. Agric.*, 1960, 11 (7), 381.—Gas chromatography has been used to analyse the ethylene produced by stored

apples. This was achieved by using a sensitive flame ionisation detector and a column long enough to separate ethylene from possible interfering substances. Measurements of the rate of ethylene production by apples stored in various concentrations of carbon dioxide show that high carbon dioxide concentrations have a greater retarding effect on ethylene production than on carbon dioxide production. Apples kept at room temperature for a week before storage produced ethylene at an abnormally high rate for about the next 80 days.

Specific detection of glucose on paper chromatograms, by Salton, M. R. J., *Nature*, 1960, 186, 966.—The present note describes the method of specific detection of glucose on paper chromatograms using the glucose oxidase indicator reagent called 'Glucostat'. Monosaccharides derived from polysaccharides are first separated with *n*-butanol-pyridine-water solvent system, the chromatogram dried in air and then sprayed with the 'Glucostat' reagent. If sugars are first separated with acidic solvents like *n*-butanol-acetic acid-water, the chromatograms have to be steamed for 5-10 minutes before spraying. The indicator dye, *o*-dianizidine, present in reagent locates glucose by giving a permanent pinkish-brown colour. Even 10-20 μ g. of glucose can be readily detected by this method. Quantitative estimation is, however, not possible as the coloured complex adheres strongly to the paper and is not extracted with several solvents. The amount of glucose can be determined by first eluting the separated spot and then developing the colour with 'Glucostat'. Other monosaccharides can be identified by drying the paper chromatogram in air after detecting the glucose and then overspraying with aniline phthalate.

K.L.R.

Ferricyanide reduction method for reducing sugars, by

Mateles, R. L., *Nature*, 1960, 187, 241.—Reducing sugars are estimated by the ferricyanide reduction method and its modifications based on the spectrophotometric measurement of the amount of prussian blue formed when excess ferric iron is added to the reactant mixture. This method has certain limitations particularly with concentrations greater than 150-200 μ g. of the reducing sugar. The author describes the use of oxalic acid which has long been known to peptise prussian blue sols in the ferricyanide method. The glucose-ferricyanide mixture is heated for 15 minutes on a water bath, cooled and 5 ml. of ferric iron solution and 1 ml. of 0.8 per cent aqueous oxalic acid solution added rapidly to it. The volume is made up to 25 ml. and after standing for 15 minutes, the optical density at 520 $m\mu$. is measured with a Beckmann DU spectrophotometer. A reagent blank experiment is also done. The optical density-glucose concentration curve is a straight line obeying Beer's law up to 300 μ g. of glucose. The reactant solution is perfectly clear even after standing for 1-2 hours while if gums are used to stabilize the sol, microscopic aggregates can be seen after 10-15 minutes and flocculation occurs rapidly. The reducing action of oxalic acid does not interfere in the method as it is very low. The present study points out the advantages of using oxalic acid in the ferricyanide reduction method for reducing sugars to obviate earlier limitations.

K.L.R.

ANTIBIOTICS

Thermal and nonthermal degradation of Acronize chlortetracycline in fish and some shellfish, by Kline, et al., *Food Technol.*, 1960, 14 (6), 305.—This study was undertaken to determine the effect of several processing methods on the degradation of varying amounts of CTC contained in

fish flesh. In some experiments the amounts of CTC found in the flesh initially were much greater than would be expected under commercial conditions. Purpose was to find out what level of CTC could be expected to degrade completely and the amounts remaining when total antibiotic destruction is not experienced. The following observations were made:

Frying flounder fillets in deep fat for 10 minutes completely degraded the antibiotic contained in the fillets at the levels shown. After 5 minutes of frying, at least 40 per cent of those fillets that originally contained 1 ppm CTC gave negative assays. Pan frying was slightly more effective than broiling for deactivating CTC in flounder fillets. In either case, small residues of CTC remained in those fillets that had originally assayed 3 ppm CTC and more. Pickling processes reduced activity of the antibiotic from 78 to 100 per cent in the flesh of herring—probably due to leaching and degradation which occur during pickling. In canning experiments with haddock, salmon, sardines and tuna, after the prescribed retorting time for the canned product, no antibiotic remained in the samples tested. In fact, it is likely that CTC was completely inactivated with 50 per cent of the full retorting time. In smoking experiments with Alaska cod and salmon, most loss of antibiotic activity occurred during cooking of the 'hot smoked' product. The smoke itself imparted microbiological activity, making it difficult to ascertain the precise amount of CTC degraded during the process. *Shellfish*. At all levels shown the frying of oysters reduced the amount of CTC to an average of 16 per cent of the level in the raw product; stewing reduced it to an average of 25 per cent of antibiotic from scallops that had contained up to 0.23 $\mu\text{g/g}$; at higher levels positive values began to occur. Lower CTC levels in raw shrimp showed a higher per cent retention after boiling than did higher levels,

i.e., those above 1.3 $\mu\text{g/g}$. It is concluded that for average cooking conditions and normal pickling and smoking procedures, practically no chlortetracycline is found if the antibiotic is employed at the recommended levels.

BIOCHEMISTRY AND NUTRITION

Effect of extraction rate of flour and of supplementation with soya meal on the nutritive value of bread proteins, by Guggenheim, K. and Naomi Friedmann, *Food Technol.*, 1960, 14 (6), 298.—Twenty kinds of bread were prepared from flour differing in extraction rate (74, 82, 86, 90 and 95 per cent) and fortification with soya meal (0, 6, 9 and 12 per cent). Lysine per gram of nitrogen increased with both extraction rate and percentage of soya. Threonine increased and methionine decreased with the percentage of soya, and both did not appreciably change with extraction rate. The nutritional value of bread proteins was assessed by determining the net protein ratio (NPR). When only bread provided dietary protein, the NPR rose as the percentage of extraction of soya added increased. Soya improved the nutritive value of proteins of both white and dark breads. When bread supplied one half only of dietary protein, the other half being derived from casein, neither extraction rate nor soya improved the nutritional value of the protein. Whereas lysine is the limiting amino acid in bread proteins and is supplied in increasing amounts by increasing the percentage of extraction or of soya added, this amino acid is not limiting in bread-casein diets. Improvement of the nutritional value of dietary proteins by increasing the percentage of flour extractions or fortification with soya meal may, therefore, be expected in diets in which wheat products represent the predominant source of protein.

CEREALS

A photomicrographic study of mechanically damaged wheat starch, by Sandstedt, R. R. and Helen Schroeder, *Food Technol.*, 1960, 14 (6), 257.—The damage that occurs to starch during wheat flour milling has long been known to be a factor influencing the baking properties of the flour. Damage to the starch is largely responsible for differences in water absorption, handling properties of the dough, sugar production and slackening during fermentation. It also has been shown to affect loaf volume and the tenderness of the crumb. Recently, increased emphasis has been placed on starch damage and on methods for its determination because of the advent of new methods of wheat conditioning, impact milling, air classification of flour fractions, and continuous bread making procedures. The purpose of this paper is to show the characteristics of damaged wheat starch by means of photomicrographs. Figure 17 of this article brings together in one picture the rapid swelling and digestion of damaged starch in comparison with the very slow subsequent digestion of undamaged portions of the granule.

FISH

Amino-acid composition of herring (*Clupea harengus*) and herring meal. Destruction of amino-acids during processing, by Gjermund Boge, *J. Sci. Fd. Agric.*, 1960, 11 (7), 362.—The complete amino-acid composition has been determined for herring, herring meal and intermediates in the production of latter. The values found for herring meal agree fairly well with earlier published data. No destruction seems to take place under processing at 'Optimal' conditions, while condensing of press water at extremely high temperature causes severe damage to several amino-acids. Destruction of amino-acids is also pronounced in heat-damaged herring meal.

Nutritive value of fish. II. Biotin, folic acid, pantothenic

acid and free amino acids of various salt-water species, by Loughlin, M. E. and Teeri, A. E., *Food Res.*, 1960, 25 (4), 479.—The AA have reported quantitative information concerning biotin, folic acid, pantothenic acid and qualitative information regarding free amino acids present in market fresh samples of various species of salt-water fish including shellfish. In the case of mackerel, a unique difference is noted, *viz.*, the absence of the dipeptide, anserine, which occurs in all the other species studied. Presence of several water soluble peptides in the fish muscle is indicated since on hydrolysis of the water extracts of most species, the amino acid distribution shows a greater variety and a higher concentration.

B.V.S.

FLAVOUR

A study of a spectrophotometric method for the flavour evaluation of insecticide treated vegetables, by Daniel Rosenfield, *et al.*, *Food Res.*, 1960, 25 (4), 513.—Untreated and insecticide treated vegetables with flavour differences were lyophilized. Solvent extracts of the lyophilized vegetables and their condensates obtained during lyophilization were examined in the visible, ultraviolet and impaired regions for spectral differences.

Differences in spectra were observed with carbon disulphide extracts of the condensates in the impaired region. No differences were found in extracts of the lyophilized vegetables in different spectral regions with one exception. Ethyl alcohol extracts of control and BHC-treated carrots and turnips had different spectra in the ultraviolet region.

B.V.S.

FRUIT AND VEGETABLE PRODUCTS

Effect of variety and maturity of fruit on acetylmethylcarbinol and diacetyl content of fresh citrus juices, by Hill, E.C., *et al.*, *Food Technol.*, 1960, 14 (6), 268.—Acetylmethylcarbinol and diacetyl

in citrus juice are detectable by colorimetric methods based on the Voges-Proskauer reaction. Lactic acid bacteria, especially *Lactobacillus* and *Leuconostoc*, are active producers of these substances in citrus juices. During the evaporation of juice in manufacturing orange concentrate, a build-up of these microorganisms may occur and accumulate diacetyl. Diacetyl may produce an undesirable 'butter-milk' off-flavour. Since acetylmethylcarbinol and diacetyl are metabolic products of microorganisms, any increase of these compounds in juice indicates increased microbial activity. The diacetyl test, sufficiently sensitive to both acetylmethylcarbinol and diacetyl, gives adequate warning of increased microbiological activity in juice during concentration so that proper measures may be taken to prevent spoilage of the product. Results of this study indicated a definite effect of both fruit variety and maturity on the diacetyl value of fresh citrus juices. Pineapple and Valencia orange and Marsh grapefruit juices showed definite and consistent increases in diacetyl values as the fruit advanced in maturity. Dancy tangerine, Hamlin orange, and Duncan grapefruit juices showed an upward trend in diacetyl values, although data for individual juice samples were erratic. Diacetyl values were due most probably to acetylmethylcarbinol. A high diacetyl value of freshly extracted citrus juice may give some indication of maturity without reflecting the quality of the juice as to flavour or microbial content.

Quality of cabbage dehydrated after chemical or steam inactivation of enzymes, by Makower, R. U. and Boggs, M. M., *Food Technol.*, 1960, 14 (6), 295.—This study reports a comparison of two methods of enzyme inactivation, by steam and by chemical means, in dehydrated cabbage. Ascorbic acid content, physical and organoleptic measurements of colour, and appraisal of odour and flavour were related to the method

and extent of enzyme inactivation. The effects of blanching, vacuum infiltration, drying and rehydration were also studied. A chemical method for inactivating enzymes without the use of heat was applied to cabbage before dehydration. The initial quality of chemically treated cabbage was somewhat inferior to non-infiltrated steam-blanching controls with respect to colour, flavour and ascorbic acid. Chemical inactivation, however, was equivalent to steam-blanching in effectiveness of enzyme inactivation and in stabilization of residual colour, flavour and ascorbic acid during storage for 6 months at an elevated temperature. Rehydration of cabbage resulted in large losses of ascorbic acid in all samples. The non-infiltrated and water-infiltrated, unblanched cabbage lost nearly all ascorbic acid in dehydration. Improvement in colour and flavour in AES-infiltrated cabbage was shown to be possible through method modification.

The separation of organic and inorganic acid anions in filtered tomato puree by partition chromatography, by Bradley, D. D., *J. agric. Fd. Chem.*, 1960, 8 (3), 236.—A method, employing silicic acid partition chromatographic techniques, is described for the separation of those organic and inorganic anions which contribute to the acidity of tomatoes. Acids were converted to the hydrogen form by passing filtered puree through the cation exchange resin, Dowex-50. Titratable and total acidity were determined by titrating an aliquot of filtered tomato puree before and after resin treatment, respectively, with 0.1 N sodium hydroxide to a phenol red end point. Separation of acids was quantitative and total recovery was approximately 94 per cent of the total acidity. Then acids (acetic, lactic, fumaric, malic, pyrrolidone carboxylic, citric, phosphoric, hydrochloric, sulfuric, and galacturonic) were found to be present in the filtered tomato puree. The phosphate, chloride, sulfate, and galacturonate ions had not pre-

viously been separated from tomato puree by partition chromatography or reported as constituents of the total acidity.

Lactic acid production by fermentation of citrus peel juice, by Kagan, J. J., Pilnik, W. and Smith, M. D., *J. agric. Fd. Chem.*, 1960, 8 (3), 236.—Citrus peel juice is produced in large quantities during the manufacture of canned citrus juices. A study was undertaken to determine the possibility of producing lactic acid by fermentation of this waste juice. Fermentations were conducted at 45° C in the presence of excess calcium carbonate to neutralize continuously the acid formed. A naturally occurring lactobacillus isolated from a fermenting grapefruit juice was able to accomplish a 90 per cent efficient conversion of sugars to lactic acid in a period of 4½ to 5 days only in the presence of accessory nutrients. Growth factors supplied by yeast autolyzate or malt sprouts were particularly beneficial. Analyses of the fermentation runs were considerably simplified by the use of a cation exchange method for determining the lactic acid produced during fermentation in the presence of calcium carbonate.

Flavonoid pigments of *Lathyrus odoratus*, by Harborne, J. B., *Nature*, 1960, 187, 240.—*Lathyrus odoratus*, the sweet garden pea, has been analysed for the pigments present in it by paper chromatography and absorption spectrophotometry. Three deep coloured varieties, Air Warden (scarlet cerise), Harrow (deep carmine) and Jupiter (deep purple), each representing a separate colour class with respect to the anthocyanins, have been used for the study. Nineteen anthocyanins and three flavonol glycosides have been isolated and identified. Their distribution in the three varieties of pea is given. Most varieties are found to contain, besides the three flavonol 3-rhamnosides, several other flavonol glycosides in small quantities. The study reveals the presence of two new series of anthocyanidin

glycosides, the 3-rhamnosides and 5-glucoside-3-rhamnosides in *Lathyrus*. The present discovery of five different kinds of glycosides in the sweet pea indicates that domestication has a marked effect on pigment synthesis. Contrary to an earlier report, related anthocyanidins and flavonols are found to occur together in all the varieties—examined indicating the close biosynthetic relationship that exists between the two classes of pigments.

K.L.R.

Colour measurement and deterioration in grape and berry juices and concentrates, by Ponting, J. D., Sanshuck, D. W. and Brekke, J. E., *Food Res.*, 1960, 25 (4), 471.—The work reported here includes studies on temperature conditions and rates at which colour of red-pigmented juices changes perceptibly as well as a means of evaluating the colour and colour changes of a given product during processing or storage. Experimental details regarding the preparation of juices and concentrates are given. The colour characteristics of juices of grape, strawberry and boysenberry have been determined by spectrophotometric measurements. Thermal degradation of the red colour of these juices is expressed in terms of time necessary for a 10 per cent decrease in absorbancy at the absorption maximum of each juice. The absorption spectra of boysenberry concentrates stored at different temperatures illustrated a progressive change in colour from red to brown.

B.V.S.

MALTING

Kaffircorn malting and brewing studies. IV—The extraction and nature of the insoluble amylases of kaffircorn malts, by Novellie, L., *J. Sci. Fd. Agric.*, 1960, 11 (7), 408.—The α - and β -amylases produced by the germination of kaffircorn may be either soluble or insoluble depending on the variety of the kaffircorn. The insoluble amylases occur chiefly in malts from 'birdproof' kaffircorn

and sweet sorghum. The amylases of these varieties, unlike the bound amylase of barley, are active in the insoluble state. Proteins, peptone, ethylenediamine, histidine and compounds containing the group—N.C (X). N—(where X is not oxygen) effect maximum liberation of the insoluble amylases. Partial solution is obtained with salts, surface-active agents and certain basic substances. The release of the amylases is not a proteolytic process but possibly a desorption from the surface of an insoluble protein.

NUTS

Effect of moisture content on the storage of Brazil nuts, by Ayerst, G. and Budd, D., *J. Sci. Fd. Agric.*, 1960, 11 (7), 390.—Current practice in the collection, handling and storage of Brazil nuts is described. Laboratory and field methods of determining moisture contents, the relationship between moisture content and relative humidity, and the effect of moisture content on respiration rate have been investigated. In storage experiments, deterioration was slow both at very low and very high moisture content whereas rather rapid spoilage occurred at intermediate levels. These findings are discussed with reference to current commercial practice and work on other seeds.

SPICES

Effect of electron beam irradiation on the microbial content of spices and teas, by Lerke, P. A. and Farber, L., *Food Technol.*, 1960, 14 (6), 266.—Spices are known to be contaminated to varying degrees with mold spores, yeasts, bacteria and sometimes with insects. This contamination represents a potential source of trouble when the spices are incorporated into food preparations such as sausages and other ready-to-serve meats. To eliminate this possible cause of spoilage raw spices are generally treated to reduce the microbial and insect content. Radiation treatment seemed to be

worthy of study as a possible alternative to other methods. The effect of a dose of 2 megarep of irradiation from a resonant transformer electron beam generator on the content of bacteria, yeasts and molds of oregano, sweet basil, sage, allspice, cinnamon, cloves, ginger, nutmeg, of black and cayenne peppers, of chili powder and of paprika was shown to be quite striking. The microbial populations of the products were completely eliminated or reduced to insignificant levels. Some effects of the irradiation treatment on the odours and content of volatile reducing substances are discussed and exemplified. In the few products studied there was a noticeable change in the type of odour complexes noticeable sensorily and in their content of VRS.

STATISTICAL EVALUATION

A note on the analysis of consumer preference data, by Otto Dyskstra, Jr., *Food Technol.*, 1960, 14 (6), 315.—Results of a recently published article on a consumer survey, in which strawberry ice cream varying in sugar content (15.9%, 17.2% or 20.8%) was evaluated, were reworked. Using a method analogous to the Terry-Bradley-

Davis method of paired comparisons, it was found that the consumer panel preferred both the sample with 19.2 per cent sugar and the sample with 20.8 per cent sugar to a statistically significant degree over the other two samples. It is concluded that the method of analysis discussed in the present article is more powerful than the method used by the authors of the original article, since they did not find that the sample with 20.8 per cent sugar was preferred to a significant degree over the samples with 15.9 per cent and 17.6 per cent sugar.

TEA

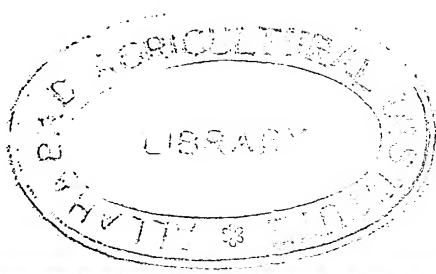
Variation in the nitrogen content of tea leaves, by Barua, D. N. and Deb, S. B., *J. Sci. Fd. Agric.*, 1960, 11 (7), 366.—Data are presented showing the relationship of the nitrogen content of tea leaves to the level of nitrogenous manuring, to the position in plucked and unplucked shoots, and to various genetic and environmental factors. In carrying out comparative studies of the chemical constituents of tea leaves it is suggested that sampling should be confined to a particular leaf in a specified position on the stem. Samples drawn from plucked shoots should consist of the second leaves of comparable shoots taken

from bushes growing in the inner rows of a plot.

GENERAL

A modern evaluation of foods, by Kohman, E. F., *Food Technol.*, 1960, 14 (6), 312.—It is suggested that calorie content be related to nutrient content in evaluating foods. Our newer knowledge of nutrition permits the development of tables that would correlate calories and amounts of nutrients in the various food categories (vegetables, fruits, basic foods, etc.). The author supplies some sample tables of this type.

The browning of ascorbic acid, by Scott F. Jackson, *et al.*, *Food Res.*, 1960, 25 (4), 484.—The effect of light and metal upon the darkening of ascorbic acid-buffer solutions of dilute concentrations is reported. The browning reaction of ascorbic acid in a buffer of pH 7 aerated with oxygen gives rise to intermediates which are light sensitive and sensitive also to the presence of heavy metals. In systems devoid of heavy metals, dehydro-ascorbic acid or diketo-gulonic acid may be substituted for ascorbic acid. The carbon dioxide evolved in the darkening of ascorbic acid in oxygen at pH 7 is derived mainly from the ascorbic acid. B.V.S.

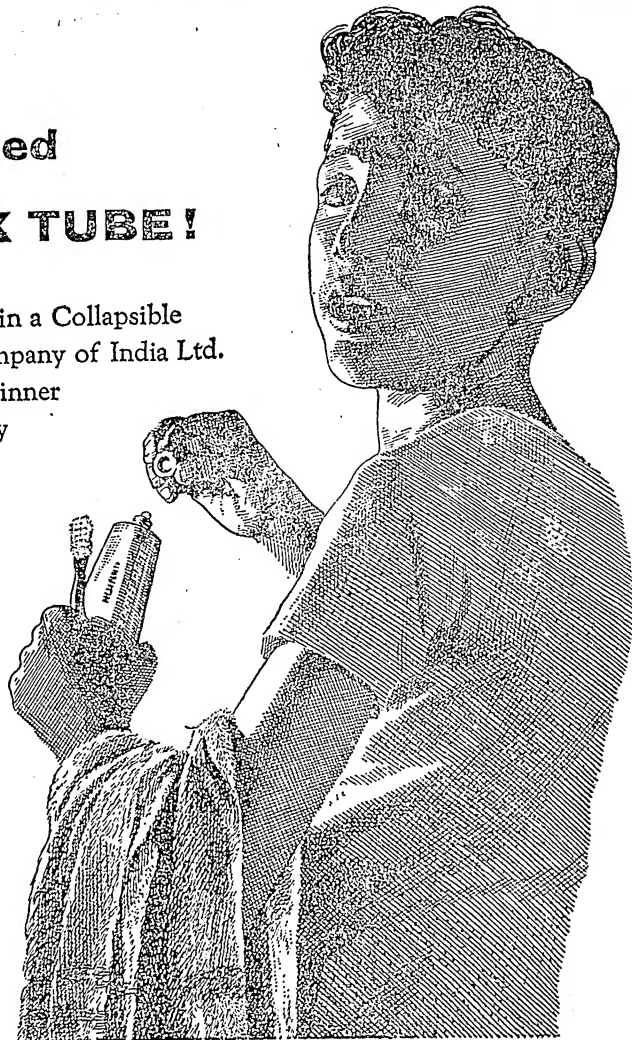


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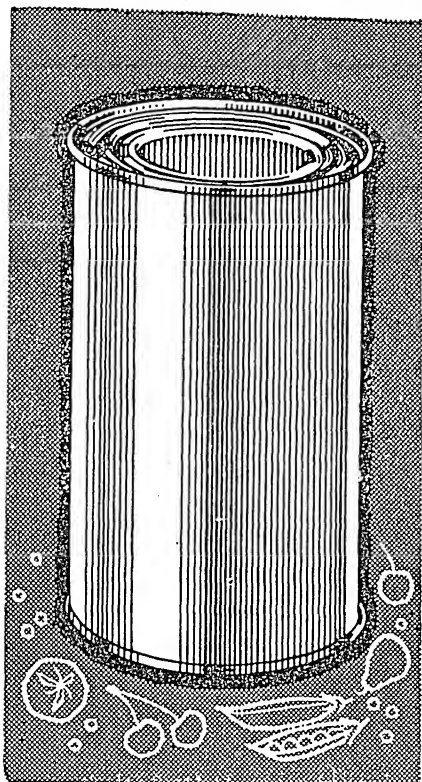
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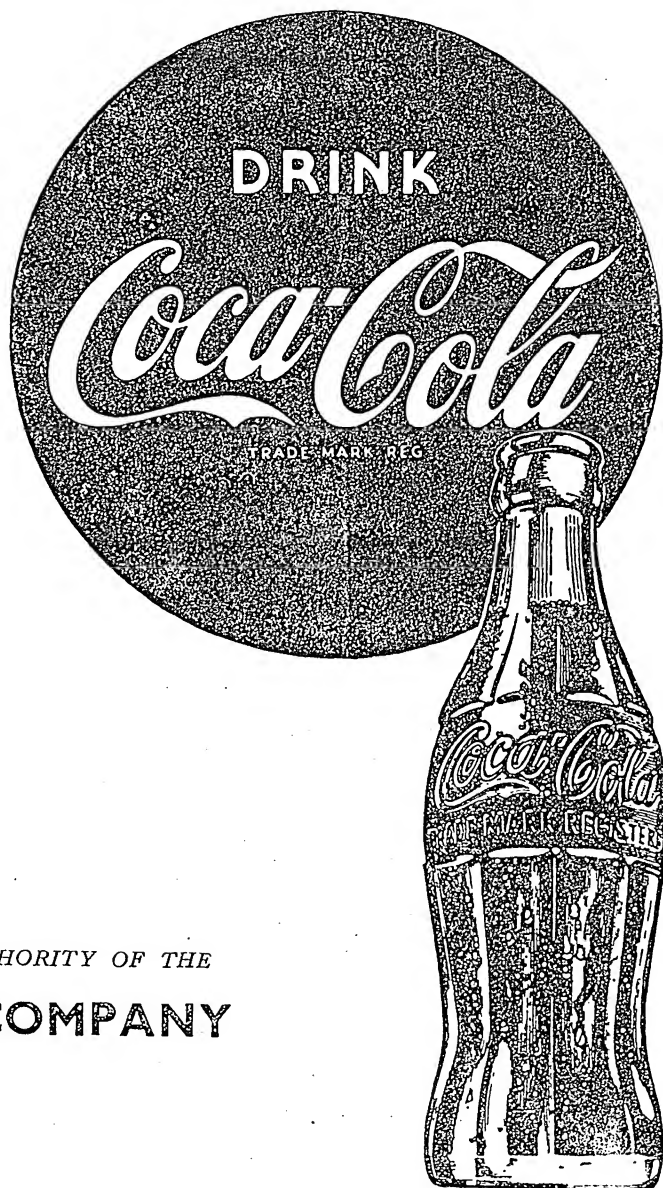
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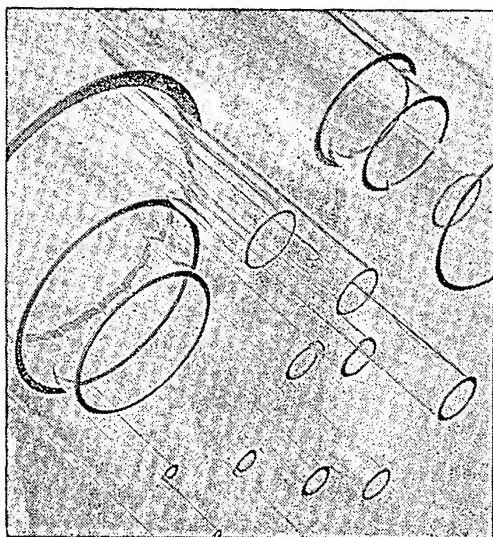
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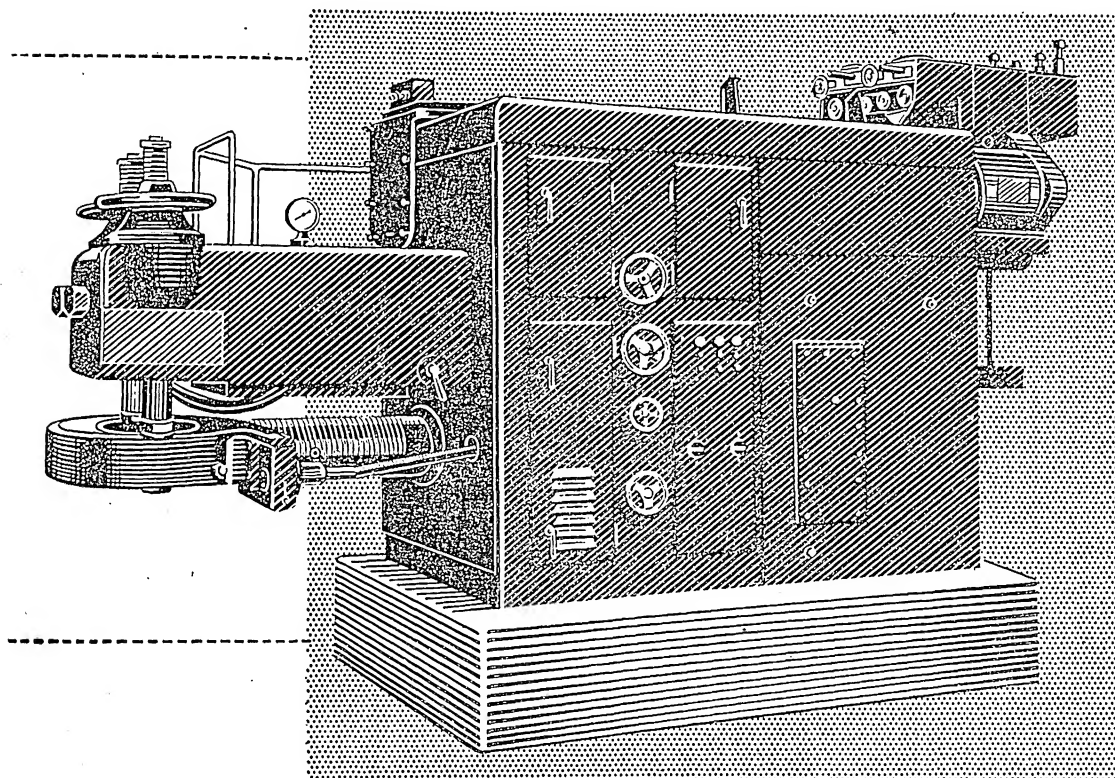
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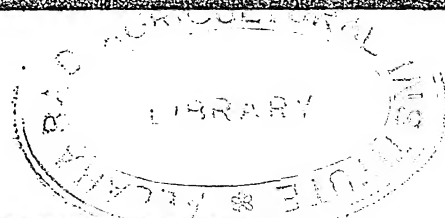


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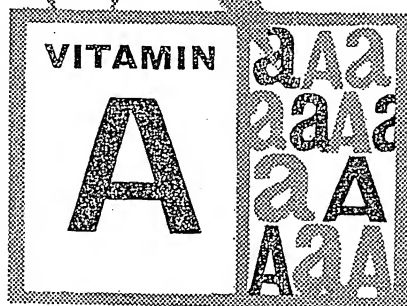
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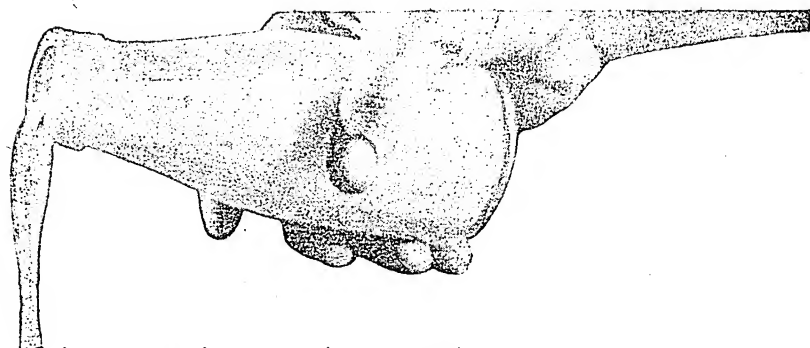
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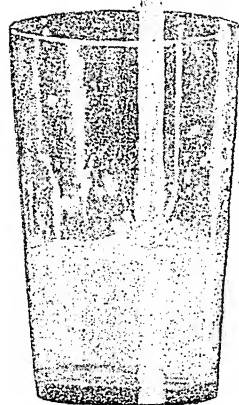
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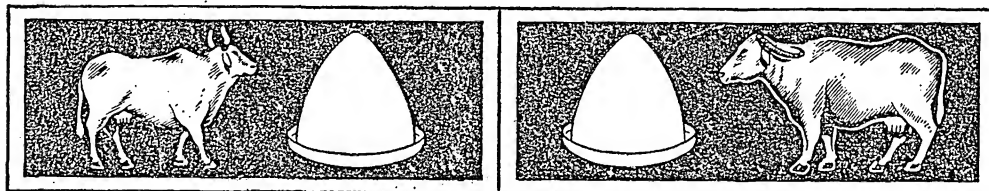
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FRUIT AND VEGETABLE PRESERVATION INDUSTRY IN INDIA

(pp. xiv + 485)

This publication embodies the Proceedings of a Symposium held at the Central Food Technological Research Institute, Mysore, under the Presidentship of Late Dr S. S. Bhatnagar. More than 100 delegates from all parts of the country representing horticulturists, fruit and vegetable products manufacturers (both indigenous and modern), and allied industries like *Machinery, Additives, Packaging*, etc., participated in it.

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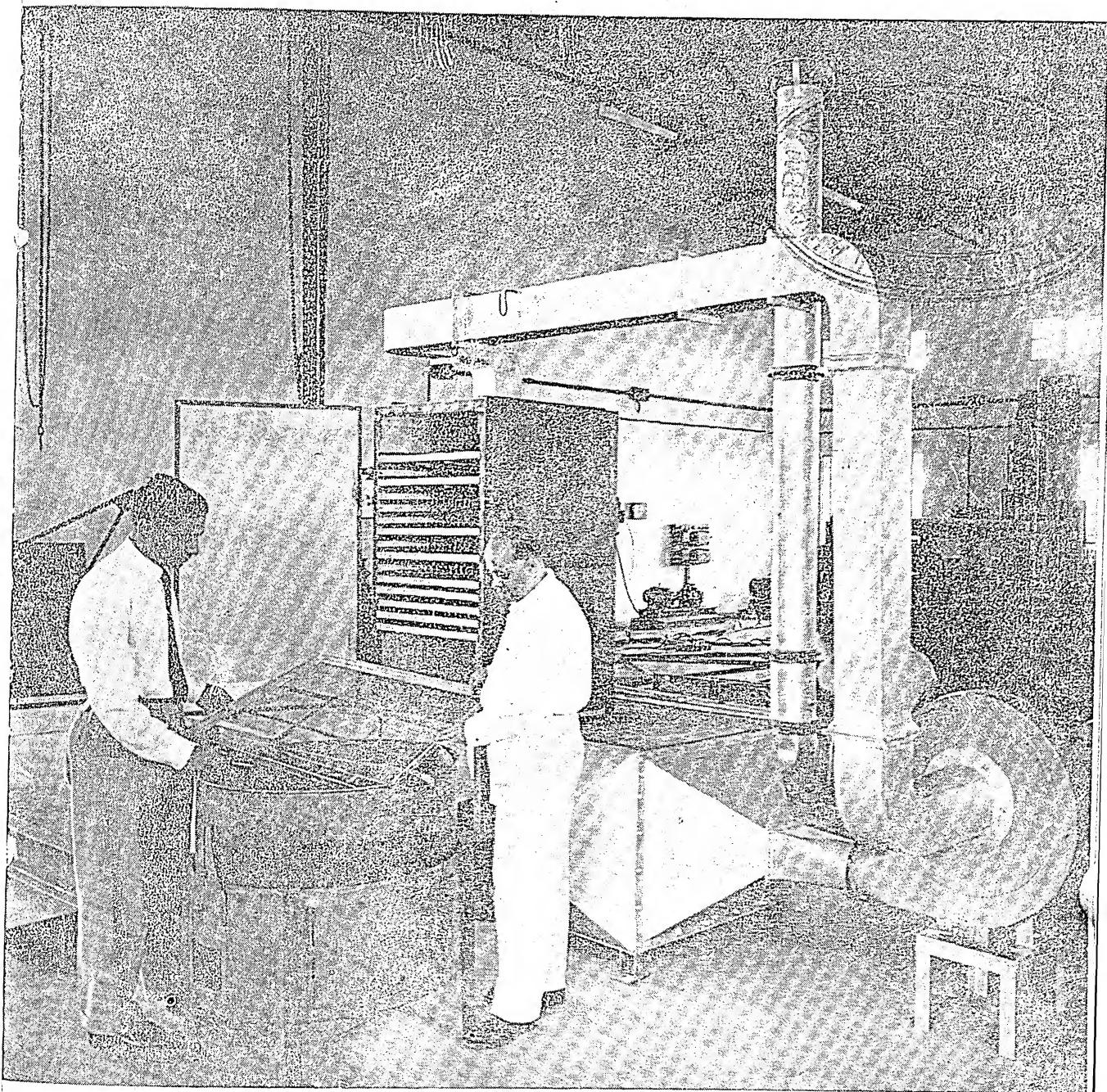
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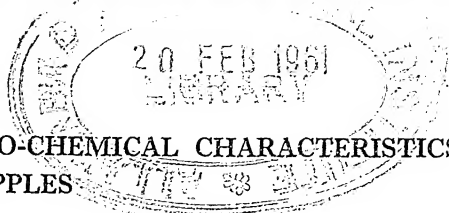
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VARIETAL DIFFERENCES IN THE PHYSICO-CHEMICAL CHARACTERISTICS OF INDIAN APPLES

By J. S. PRUTHI, C. M. PAREKH AND GIRDHARI LAL

(Central Food Technological Research Institute, Mysore)

Variations in the physico-chemical characteristics of 10 varieties of apples grown in Kashmir have been presented and discussed. The ten varieties studied are Lal Ambri, Golden Delicious, Red Delicious, Lal Turesh, Lal Turesh Nawabi, Tarial Kesri, Rajai Kashmiri, France Kashmiri, Red Pippin and Yellow Pippin.

Sugars constituted the major portion of the total carbohydrates and reducing sugars alone comprised 70-90% of the total sugar make-up. The acidity ranged from 0.47 to 0.73% W/W as malic acid. There was no significant difference in different varieties in respect of total astringency. All varieties were rich in pectin (3.35 to 3.73% on fresh weight basis) but poor in ascorbic acid (5.84-9.89 mg.%), protein (0.06-0.3%) and iron (0.48-1.35 mg.). Their relative dessert quality, fruit weight, fruit size and their suitability for technological purposes have also been discussed.

A survey of literature¹ revealed that though considerable work had been done overseas², little published information was available on varietal differences in the physico-chemical composition of Indian apples except for the work of Singh and Lal³ who reported the specific gravity, °Brix, acidity and tannin content of juices of 19 varieties of apples (grown in Kulu valley) purely from the point of view of cider making. The present report covers detailed physico-chemical characteristics of 10 varieties of Kashmir apples hitherto not reported in literature.

Experimental

Raw material: Ten varieties of Kashmir apples, namely, *Lal Ambri* (or *Amri*), *Golden Delicious*, *Red Delicious*, *Lal Turesh* (or *La Trough*), *Lal Turesh Nawabi*, *Tarial Kesri*, *Rajai Kashmiri*, *France Kashmiri*, *Red Pippin* and *Yellow Pippin* (Plates I & II) purchased through a local (Mysore) fruit contractor were used.

Physical characteristics: Twelve healthy fruits picked at random from each of the different varieties were individually examined for weight, diameter and height.

Analytical methods: One lb. random samples from each of the 10 lb. lots of apples were utilised for analysis. Individual fruits were hand-peeled, cored and cut into small pieces with stainless steel knives. Immediate analyses of aliquots thereof were conducted for moisture, ascorbic acid, sugars and acidity. The other constituents (Table 2) were determined during the course of 3-4 days, during which period, the prepared material was kept in small, brown, capped and waxed bottles in a freezer at 20° F till required for analysis. All items of analysis were conducted in duplicate.

Moisture, acidity, crude fibre, ash and calcium were determined by the standard A.O.A.C. methods⁴, pectin by Carre and Hayne's⁵, sugars by Lane and Eynon's⁶, protein by the micro-Kjeldahl's⁷, phosphorus by Fiske and Subba Rao's⁸, iron by Wong's⁹ and true ascorbic acid by Robinson and Stotz's¹⁰ methods.

FOOD SCIENCE

NOVEMBER 1960

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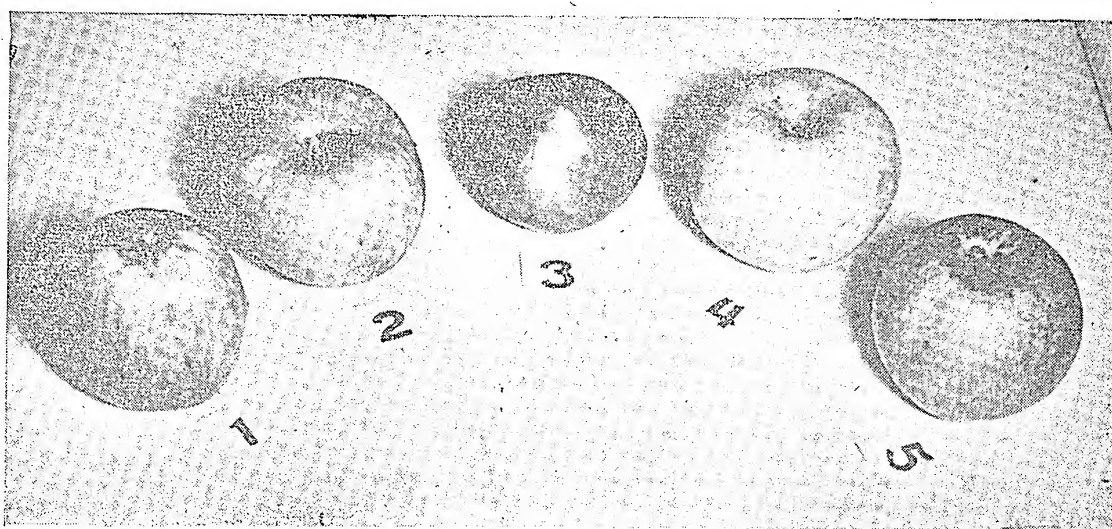


Plate I. VARIETIES OF INDIAN APPLES: 1. Lal Amri 2. Rajai Kashmiri 3. Red Pippin 4. Yellow Pippin 5. Red Delicious

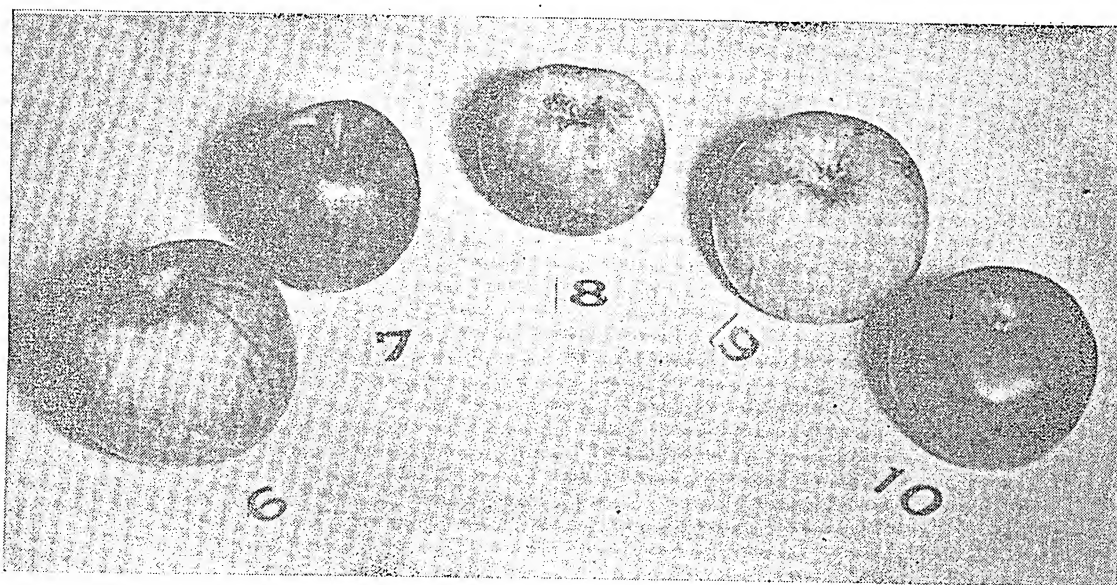


Plate II. VARIETIES OF INDIAN APPLES: 6. France Kashmiri 7. Lal Turesh 8. Lal Turesh Nawabi 9. Tarial Kesri 10. Democrat (imported from Australia)

Colour of the flesh of different varieties of apples was evaluated by measuring the per cent light transmission of the acetone extracts of macerated apples (5g./50 ml.) at 420 and 650 $m\mu$.

Organoleptic evaluation: Freshly sliced apples of different varieties were presented to a panel of judges comprising ten members of the scientific staff of the Division, to determine their suitability

for table purposes. Only mean values for taste scores have been presented and discussed.

Results and Discussion

Data on the physical and chemical characteristics of different varieties of apples are given in Tables 1 and 2 respectively.

Physical characteristics: From the viewpoint

TABLE 1. *Physical characteristics of ten varieties of Indian apples*

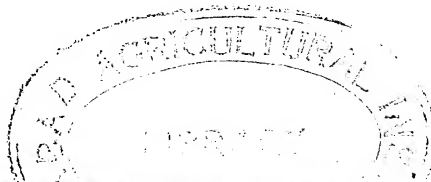
Varieties of apples	External appearance and colour	Av. fruit weight (oz.)	Fruit dimensions		Colour of flesh			Organoleptic evaluation		
			Diameter (cm.)	Height (cm.)	Colorimetric reading at		Visual colour	Texture of flesh	Taste	Mean taste score 100
					420 m μ	650 m μ				
Lal Ambri	Pink to red	3.0	6.5-8.5	5.0-6.5	78.0	93.0	White	Firm	Normal	59
Golden Delicious	Greenish	2.9	5.1-6.1	5.0-5.9	70.5	94.0	White	Medium	Normal	59
Red Delicious	Yellowish red	3.5	6.0-7.0	5.0-6.2	73.0	94.0	Light yellow	Soft	Acidic	56
Lal Turesh Nawabi	Red	2.6	5.3-6.2	5.4-6.3	65.0	89.5	White	Medium	Slightly acidic	59
Lal Turesh	Red	3.3	5.3-6.4	6.0-6.4	70.0	90.0	White	Firm	Acidic	58
Tarial Kesri	Kesri colour	4.3	6.3-7.0	5.5-5.9	73.0	90.0	Light yellow	Firm	Acidic	58
Rajai Kashmiri	Light greenish yellow	5.2	7.0-8.0	5.6-6.5	72.5	93.0	White	Medium	Normal	65
France Kashmiri	Pale greenish with reddish tinge	3.9	7.0-7.4	4.0-4.5	61.0	91.0	Pale greenish	Soft	Normal	63
Red Pippin	Deep red	2.4	5.3-7.0	4.1-4.8	75.0	91.5	White to pale greenish	Medium	Good	70
Yellow Pippin	Light yellow	4.7	6.0-7.0	5.0-6.0	86.5	92.0	Pale greenish yellow	Medium	Good	78

* Per cent light transmission of 50 ml. acetone extract prepared from 5g. of flesh in each case.

TABLE 2. *Comparative chemical composition of ten varieties of Indian apples (Season: Oct.—Nov., 1954)*

Chemical characteristics	VARIETIES									
	Lal Ambri	Golden Delicious	Red Delicious	Lal Turesh Nawabi	Lal Turesh	Tarial Kesri	Rajai Kashmiri	France Kashmiri	Red Pippin	Yellow Pippin
Dry matter %	18.07	12.30	15.82	14.50	18.86	10.40	15.60	18.64	16.57	17.57
Acidity (w/w) % (As malic acid)	0.63	0.73	0.58	0.47	0.62	0.52	0.67	0.51	0.55	0.59
Reducing sugars %	10.09	5.45	7.22	7.82	8.13	9.52	8.34	9.12	8.80	8.20
Total sugars % (As invert)	12.30	7.08	9.18	9.06	9.39	12.11	8.62	9.90	11.30	10.95
Non-reducing sugars %	2.10	1.55	1.86	1.18	1.20	2.46	0.27	0.74	2.38	2.61
Sugar/acid ratio	19.90	9.70	15.80	19.30	15.10	23.20	12.90	19.40	20.50	18.50
Total astringency %	0.13	0.10	0.09	N.D.	0.12	0.12	0.13	0.12	0.11	0.13
Tannins %	0.06	0.04	0.04	N.D.	0.06	0.05	0.06	0.04	0.06	0.05
Pectin (as Ca. pectate) %	3.35	3.38	3.37	N.D.	3.73	3.39	2.54	3.73	3.57	3.32
Protein (N \times 6.26) %	0.38	0.11	0.06	0.07	0.13	0.07	0.20	0.07	0.07	0.30
Crude fibre %	1.60	1.51	1.47	1.50	1.73	2.05	1.57	2.25	1.72	1.85
Ascorbic acid (mg/100g.)	7.52	7.45	8.86	7.82	9.89	6.72	8.28	8.53	8.61	5.84
Ash %	0.34	0.26	0.22	0.25	0.31	0.26	0.29	0.20	0.35	0.33
Calcium (Ca) mg %	9.78	16.00	10.15	7.56	6.74	11.10	6.96	13.51	19.50	16.58
Phosphorus (P) mg %	12.02	18.18	18.18	7.30	7.95	8.26	8.84	7.03	16.94	8.16
Iron (Fe) mg %	1.34	0.86	0.86	0.98	0.73	0.58	0.97	0.48	0.52	1.11

N.D. = Not done.



of dessert quality, *Yellow Pippin* and *Red Pippin* were better than *Rajai Kashmiri*, *France Kashmiri*, *Lal Ambri* and *Golden Delicious*. The rest of the varieties were somewhat acidic according to Indian taste (Table 1)*.

From technological angle, medium or bigger apple fruits are preferred as less labour is involved in their preparation. The *Red Pippin* and *Lal Turesh Nawabi* apples were rather too small, while *Rajai Kashmiri*, *Yellow Pippin*, *Tarial Kesri* and *France Kashmiri* apples were of good size, the other varieties being of medium size (Table 1).

CHEMICAL COMPOSITION

Sugars: A study of Table 2 reveals that sugars constitute the major portion of carbohydrate make-up or total soluble materials. The total sugar content in most of the varieties ranged from 9.06 to 12.30 per cent except in *Golden Delicious* and *Rajai Kashmiri* wherein the sugar content was 7.08 and 8.62 per cent respectively. Further, the reducing sugars comprised 70-90 per cent of the total sugar make-up.

Acidity: The acid fraction of the fruit is of interest as it affects the eating as well as cooking quality and is also of importance in the manufacture of products like juice, cider, jam and preserves. The acid content in different varieties ranged from 0.47 to 0.73 per cent (as malic acid). The sugar: acid ratio in most of the varieties ranged from 15.10 to 20.50, except in *Golden Delicious* and *Rajai Kashmiri* wherein it was low (9.70 and 12.90 respectively) while, in *Tarial Kesri*, it was slightly high (23.20).

Astringency: There was no significant difference between varieties in respect of total astringency which ranged from 0.10 to 0.13 per cent, while tannin content ranged between 0.04 to 0.06 per cent only.

Pectin: All the ten varieties of apples were rich in pectin, ranging from 3.35 to 3.73 per cent except in *Rajai Kashmiri* which had only 2.54 per cent pectin on fresh weight basis.

Other constituents: The crude fiber ranged from 1.47 to 2.25 per cent. Apples were poor

in protein (0.06—0.30 per cent), ascorbic acid (5.84—9.89 mg/100 g.) and iron (0.48—1.35 mg./100 g.). They were only a fair source of calcium (6.74—19.5 mg. per cent) and phosphorous (7.03 to 18.18 mg. per cent).

It is, however, not possible, as would be evident from preceding discussion, to distinguish between the ten varieties examined regarding their relative quality because of the possibility of further variations within each variety when grown in different regions having different climatology and other agri-cum-horticultural conditions. The fairly high pectin content of all the varieties of apples under study makes them suitable for the manufacture of jam and jelly. In fact, excellent jellies were prepared from apple peels alone. Their suitability for dehydration¹¹ and preserve making¹² has been reported elsewhere.

Acknowledgment

Grateful acknowledgment is made to Dr V. Subrahmanyam, Director and Dr A. Sreenivasan, Deputy Director, Central Food Technological Research Institute for their keen interest in this investigation.

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* It may be added here that the estimation of the dessert quality is obviously a personal opinion. For example, Rhode Island Greening is not commonly considered a dessert apple, yet there are people who consider it of better eating quality than *Delicious*². The dessert quality is also known to vary with maturity, relative astringency or sugar/acid ratio, locality where grown and season, etc.

UTILIZATION OF PALM SUGAR IN THE PREPARATION AND PRESERVATION OF FRUIT PRODUCTS

By S. RANGANNA AND G. S. SIDDAPPA

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Palm sugar, when utilized in the preparation of fruit products, causes discolouration of the product, leaves an undesirable sediment and results in slight haziness in the case of transparent products. It affects the taste of delicately-flavoured fruits like oranges. This sugar can, however, be utilized in the preparation of certain fruit products like jams, squashes, syrups, etc., which have a dark or deep colour especially those made from highly coloured and flavoured fruits like plums, berry fruits, pomegranate, jaman, etc., without any marked deleterious change in their flavour.

The present investigations were carried out to find a suitable use for palm sugar particularly in view of the government policy to encourage its manufacture and its non-acceptability by the consumer for reasons of colour and flavour in spite of its being more nutritious.

Experimental

MATERIALS AND METHODS

Palm sugar received from the Palm Gur Adviser to the Government of India was utilised in this investigation. Analytical data for this sugar are given in Table 1. Sugars were estimated by the method of Lane and Eynon¹ and reflectance

measurements were made with a Photovolt reflection meter. Transmission readings of the syrup were taken on a Lumetron colorimeter (Model S-401).

The methods employed for the preparation of different products using palm sugar were as follows:

I. CANNED FRUITS

(a) *Pineapple slices*: Pineapple slices were canned in cans of 401' × 300' size using syrup of 45° Brix containing 0.25 per cent added citric acid. The cans were exhausted to a temperature of 85°C at the centre of the can, sealed, processed for 15 minutes in boiling water and cooled.

(b) *Orange segments in syrup*: Segments of loose jacket oranges (*Sangtra*) were lye peeled, filled into plain cans of 301' × 311' size at the rate of 9 oz. per can and covered with syrup of 50° Brix containing 0.25 per cent added citric acid. The cans were exhausted to 85°C at the centre of the can, sealed and processed at 95°C for 13 minutes and then cooled.

(c) *Mango slices in syrup*: Alphonso mango slices were canned in plain cans of 401' × 411' size using syrup of 40° Brix containing 0.1 per cent added citric acid. The cans were exhausted and processed for 20 minutes in boiling water and cooled.

II. PINEAPPLE JAM

The jam was prepared according to the following specifications:

Fruit content (on fresh wt. basis)	... 45.0%
Total soluble solids	... 70.0%
Acidity as anhydrous citric acid	... 0.7%

TABLE 1. Analysis of palm sugar

1. Moisture	...	0. 47%
2. Sucrose	...	95. 21%
3. Reducing sugars, as invert sugar	...	0. 5%
4. Water insoluble solids	...	0. 71%
5. Ash	...	0. 25%
6. Acidity (as the equivalent percentage of CaO)	...	0.009%
7. Tintometer readings for syrup of 62°Brix	...	9Y, 3.2R, 1.0B
8. Transmission at 550 mμ (using 62° Brix syrup and Lumetron colorimeter)	...	74. 0% (0.1308 optical density)
9. Reflectance colour (for solid sugar using photovolt reflection meter)	...	...
Tristimulus Amber	...	33. 25%
Tristimulus Green	...	51. 5%
Tristimulus Blue	...	11. 5%
10. Chromaticity co-ordinates	x=0.3056 y=0.5488 z=0.1456	...
11. Remarks: Syrup—Dirty yellow colour; much sediment; peculiar characteristic palm gur taste	...	...

TABLE 2. *Cut-out data of canned mango slices*

	CANE SUGAR				PALM SUGAR			
	3 months		6 months		3 months		6 months	
	R.T. (24-28°C)	37°C	R.T. (24-28°C)	37°C	R.T. (24-28°C)	37°C	R.T. (24-28°C)	37°C
Vacuum, inches ...	17.5	15.5	16.5	14.5	17.5	15.5	15.0	12.0
Head-space, inches ...	7/16	5/16	7/16	7/16	5/16	5/16	5/16	5/16
Drained weight % ...	57.73	58.2	57.2	57.5	61.35	58.2	57.38	57.73
Refractometer solids at 20°C % ...	26.3	24.8	26.2	25.6	26.3	24.5	26.2	26.5
Internal condition of can ...	Normal	Slight feathering	Slight feathering		Normal		Slight feathering	
Fruit—Appearance ...	Normal		Normal		Normal		Normal	
—Flavour ...	Full fruit flavour		Full fruit flavour	Mild flavour	Full fruit flavour		Full fruit flavour	Mild flavour
Syrup—Appearance ...	Attractive; clear yellow		Attractive; clear yellow		Unattractive; slightly cloudy; viscous; and pale yellow sediment present.		Unattractive; yellowish brown; sediment present.	
—Flavour ...	Characteristic		Characteristic		Normal		Normal	
General remarks ...	Good		Good		Fair		Fair	

TABLE 3. *Cut-out data of pineapple slices and orange segments canned in palm sugar syrup*

	PINEAPPLE SLICES				ORANGE SEGMENTS			
	3 months		6 months		3 months		6 months	
	R.T. (24-28°C)	37°C	R.T. (24-28°C)	37°C	R.T. (24-28°C)	37°C	R.T. (24-28°C)	37°C
Vacuum, inches ...	11.0	10.5	11.5	10.5	14.5	14.0	15.0	10.5
Head-space, inches ...	1/8	1/4	3/8	1/2	1/4	1/8	1/2	5/16
Drained weight % ...	55.3	58.4	50.6	55.5	49.0	30.0	49.0	50.0
Refractometer solids at 20°C % ...	25.2	26.2	25.3	25.3	25.2	24.2	25.3	24.5
Internal condition of can ...	Slight feathering		Heavy feathering		Heavy feathering	Medium feathering	Medium feathering	Heavy feathering
Fruit—Appearance ...	Attractive		Attractive		Attractive		Attractive	
—Flavour ...	Normal		Normal	Slight metallic after taste	Sweet; weak flavour of fruit		Slight after taste	After taste present
Syrup—Appearance ...	Attractive; deep yellow; sediment present		Attractive; deep yellow; sediment present		Pale yellow; sediment present		Dull yellow; sediment present	
—Flavour ...	Normal	Slight loss of flavour	Normal	Slight after taste	Mild flavour		Mild flavour	Lacked flavour
General remarks ...	Good	Fair	Good	Fair	Fair	Fair	Fair	Poor

TABLE 4. *Cut-out examination of synthetic syrups and orange squash*

	Storage period (months)	Storage temp. °C	Colour	Clarity	Flavour	General quality (Remarks)
Raspberry syrup ...	6	24-28°C	Attractive Pinkish red	Dull hazy; contains sediment	Characteristic	Good except for slight sediment and haziness
Rose syrup ...	6	37°C	do	do	do	do
		24-28°C	Attractive, Rose	do	do	do
		37°C	do	do	do	do
Pineapple syrup ...	6	24-28°C	Unattractive Brownish-yellow	do	do	Fair
		37°C	do	do	do	do
Orange squash ...	3	24-28°C	Unattractive, dull orange	Cloudy	Taste of stored product	Fair
	6	37°C	do	do	do	do
		24-28°C	Unattractive	do	Acidic, lacked orange flavour, taste of stored product	Poor
		37°C	do	do	do	do

Citrus pectin of 200 jelly grade was used to facilitate the setting of the jam.

III. SYRUPS AND BEVERAGES

(a) *Synthetic syrups: Rose, Raspberry and Pineapple:* Stock syrup of 70° Brix containing 0.1 per cent citric acid was prepared by heating the syrup to boiling, filtered and cooled. The fruit syrups were prepared from the stock syrup by adding synthetic essence and an appropriate permitted colour, *viz.*, Carmoisine for rose syrup, Fast Red E for raspberry syrup and Tartrazine N.S for pineapple syrup. The syrups prepared were packed in glass bottles of 12 oz. capacity.

(b) *Orange squash:* The following recipe was adopted:

Juice	...	25.0%
Total soluble solids	...	45.0%
Acidity as anhydrous citric acid	...	1.5%
Sulphur dioxide (in the form of potassium metabisulphite)	...	350 ppm

Vita Crush Orange essence and Edicol Orange AG colour were also added. The product was filled into 12 oz. bottles.

Similar products were prepared using cane sugar to serve as controls.

The different products prepared were stored at room temperature (24-28°C) and 37°C and examined at the end of 3 and 6 months. Eight

persons, who were well acquainted with fruit and vegetable products and their routine examination, were requested to judge the samples for their organoleptic quality.

Results and Discussion

The results of the cut-out examination of canned mango slices, pineapple slices and orange segments are given in Tables 2 and 3. The difference in the vacuum, drained weight, refractometer solids and the internal condition of the can in the products canned either in cane sugar syrup or in palm sugar syrup was not marked. The colour of the fruit was similar in both the cases; the covering syrup in the case of palm sugar, however, was more brownish than in the case of cane sugar. Further, the drained syrup in the canned product prepared from palm sugar contained a brownish sediment which tended to impart an unattractive and cloudy appearance to the product. There was no perceptible difference in flavour with the exception of orange segments which developed an after-taste at the end of 6 months.

The results of cut-out examination of stored samples of synthetic syrups and orange squash are given in Table 4. The palm sugar did not have any effect on added colour in the case of deep coloured syrups like raspberry and rose



syrups. The light coloured products, like pineapple syrup, however, failed to take up the brilliant hue of the added colour. Further, the syrups were slightly hazy in appearance, and on storage, sediment settled at the bottom of the container. There was no perceptible effect on the flavour of the product. In the case of orange squash, the product did not take up the bright hue of the added colour and was lacking in its characteristic flavour.

The following general conclusions may be drawn from the experimental data:

1. Palm sugar does not have any perceptible effect on the flavour in the case of highly flavoured fruits like mango or pineapple.

2. Palm sugar imparts a deep brown colour to the syrup in spite of clarification with citric acid and boiling, while cane sugar syrup prepared in a similar way is colourless or pale white in colour. Light-coloured products like pineapple

syrup and orange squash do not therefore take up the bright hue of the added colour.

3. It contains insoluble matter which causes haziness in synthetic syrups and is also responsible for the formation of sediment in canned fruits and synthetic syrups. This is, however, masked to some extent by fruit pulp in the case of squashes.

Acknowledgment

The authors wish to express their sincere thanks to Dr V. Subrahmanyam, Director, and Dr Girdhari Lal, Assistant Director, for their keen interest in this investigation and to the Palm Gur Adviser to the Government of India for the generous supply of palm sugar. Thanks are due to Sri Lakshminarayana Setty for the analysis of of palm sugar.

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THE EFFECT OF INCORPORATION OF MANGO CUSTARD IN MILK DIETS ON THE GROWTH AND COMPOSITION OF LIVER OF RATS

Supplementation of the daily diet with orange juice and fruits has been shown to improve the nutritional status of children^{1,2}. A preliminary account of the results of studies on strained baby foods containing mango pulp in supplementing milk diet is given in this note.

The two strained baby foods used in the investigation were canned mango custard and dehydrated mango custard (mangotin) both of which contained mango fruit pulp. The method of preparation of these products have already been described³. Samples of canned and dehydrated mango custard were analysed for protein, calcium, ascorbic acid and carotene contents by the methods described in A.O.A.C.⁴ The results are given in Table 1.

The composition of the experimental diets are given in Table 2. Cow's milk and mango custard formed 80 per cent and 20 per cent in the diet on dry weight basis. As both canned and dehydrated mango custard contained some quantity of skim milk powder, an equivalent amount of skim milk powder was added to the control diet. Sugar also was added to the control diet to equa-

TABLE 1. *Nutritive value of the strained baby foods*
(Values per 100g)

Strained baby food	Moisture (g)	Protein (N x 6.25) (g)	Calcium (mg.)	Ascorbic acid (mg)	Carotene (μg)
Canned mango custard	69.5	2.05	72	17	6,000
Dehydrated mango custard (Mangotin)	1.3	7.09	238	32.8	12,000

TABLE 2. *Composition of the experimental diets**

	Diet I	Diet II	Diet III
Cow's milk (ml) ...	640	640	640
Canned mango custard (g) ...	...	65.6	...
Dehydrated custard (g) ...	...	...	20.0
Skim milk powder (g) ...	3.2	...	...
Sugar (g) ...	16.8	...	...

* Dry weight of the above diet is 100 g.

lise the carbohydrate supplied by the mango custard in the experimental diets.

Three groups of freshly weaned young rats (12 rats in each group weighing about 40-45 g. and distributed equally according to sex, litter and body weight) were fed on the different diets for a period of 8 weeks. The diets were prepared fresh every day and were given *ad libitum* to the rats. Records of the individual food intake and weekly increase in body weight were maintained. Data on the average weekly increase in weight of rats and daily food intake are given in Table 3.

TABLE 3. *The effect of incorporation of mango custard in a milk diet on the growth of albino rats*

Diet	Average initial wt. (g)	Average daily food intake (dry wt.) (g)	Average weekly gain in wt. (g)
Milk diet (control) ...	47.0	8.1	13.21
Control+canned mango custard	47.2	8.3	14.36
Control+dehydrated mango custard	46.8	8.4	14.19
			± 0.35 (20 d.f.)

The results on statistical analysis showed a significant difference between the growth rates of animals fed on the control milk diet and the same supplemented with mango custard.

After a period of 8 weeks, the animals were sacrificed and the livers removed and analysed for moisture, protein and fat according to the methods referred to by Joseph *et al.*⁵. The results are given in Table 4.

The results on statistical analysis showed that the fat content of the livers of animals fed on the experimental diets containing canned or dehydrated mango custard was significantly lower than that of animals fed on the control diet. No significant difference was observed either in the

TABLE 4. *Chemical composition of the liver of rats fed on the different diets*

Diet	Average body wt. (g)	Average wt. of liver (g)	Composition of fresh liver		
			Moisture %	Protein % (Nx6.25)	Fat %
Milk diet (control) ...	152.6	6.18	69.0	20.89	3.27
Control+canned mango custard	162.0	5.75	69.2	20.59	2.97
Control+dehydrated mango custard ...	160.0	5.83	67.6	20.62	2.74
			± 0.72 (20 d.f.)	± 0.20 (20 d.f.)	± 0.12 (20 d.f.)

moisture or protein content of the livers of the different groups of animals. The weights of livers of rats receiving the control milk diet were slightly higher than those receiving the experimental diets containing mango custard. Further details on the effect of strained baby foods on the composition of blood and body of the experimental animals will be published later.

We are thankful to Mr A. N. Sankaran for help in statistical analysis, to Drs M. Swaminathan and Girdhari Lal for helpful suggestions and to Dr V. Subrahmanyam, Director of the Institute for his keen interest in the present investigation.

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Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during October 1960 are given in this section.

S(IS) 24

Studies on arecanut, by V. S. Govindarajan and A. G. Mathew (October 3, 1960).—Introducing the subject, Mr. V. S. Govindarajan said that *pan*-chewing of which arecanut is an important ingredient, was practised by more than a hundred million people of the human race. The arecanut crop is confined mainly to the regions of South East Asian countries and is an important plantation crop of India, covering nearly three lakh acres with an annual production of 22 lakh maunds, fetching about 30 crores of rupees. The demand for the commodity is so large that several lakh maunds have to be imported every year from the neighbouring countries.

Kerala, Mysore and Assam produce the major part of the total arecanut production. The producing centres of Kerala and Assam consume mostly raw, ripe nut. Mysore, Madras and Andhra Pradesh consume the processed tender nut, popularly called *kalipak* while the rest of India consume the dried ripe nut, popularly called *chalisupari*. Kerala produces a large variety of *kalipak*, for marketing in other areas principally Madras and Andhra. Recently, in Kerala a small amount of ripe dry nuts is also produced. Bombay, Assam and West Bengal produce only the ripe dry nuts while Mysore and Madras produce both types.

There are more than two hundred trade varieties, each having a special market. The process of making major types of arecanuts from nuts of different maturities was then described, including the processed nuts such as the 'scented *supari*' of the South and special *suparis* of Lucknow and nearby areas.

The major problems of arecanut industry in India are: increasing the production; improving the quality of products, avoiding waste, utilization of by-products and better marketing. Researches on these problems have been organised by the Indian Central Arecanut Committee through the Central and Regional Arecanut Research Stations. Problems connected with improved processing, avoiding waste and utilization of by-products have in recent years been attempted under research schemes at different Universities and more recently in this Institute with the setting up of the Arecanut Technology Unit. Systematic work on the analysis of main constituents at different maturities have recently been undertaken to understand the traditional processing of the different types used in different areas and standardize the methods and products.

Drying of whole and processed nuts is a problem due to the coincidence of monsoon with the harvesting time in some areas. Further, the raw ripe nut in its fresh state is a favourite product and the preservation of such nuts in fresh condition for periods of up to 6 months for use in the off-season is a problem of great economic importance and immediate utility. The present method of steeping in water or storage in pits results in foul-smelling and decayed nuts.

The speaker referred to other problems such as storage of processed nuts, detection of adulteration, utilization of arecanut husk and the study of the physiology and pharmacology of chewing.

Mr. Mathew then presented the results on the chemistry of nuts harvested at different stages of maturity and during processing,

and of the final market products. He discussed the results in relation to problems of storage, processing and utilization.

In order to study the changes in composition, arecanuts plucked at three stages of maturity, *viz.*, stage 1—tender nuts of about 3 months maturity, stage 2—green nuts used for *kalipak* of about 5 months maturity and stage 3—ripe arecanut of about 7-8 months maturity, have been analysed.

Arecanuts contain a good percentage of 'tannins', the plant polyphenols, which contribute greatly to the taste of the product. It was found that polyphenols form about 50 per cent of the dry tender kernel and with maturation, the concentration goes down to about half in the stage 2 and to about one-third when ripe. However, when calculated as amount per nut, the polyphenols showed continued increase till the end. Thus, it will be seen that the rate of formation of polyphenolic matter is greatly reduced with maturity and its concentration is only diluted with the rapid formation of other constituents.

Alkaloids seem to be showing a slight increase with maturity. The tender arecanuts are found to be more astringent and physiologically active than a ripe one and this indicates that polyphenols contribute considerably to the taste and physiological properties. In addition to the reduction in the concentration of polyphenolic matter, there is evidence to show that there are also changes in the polyphenols, like oxidative-condensation resulting in bigger molecules, which explains the reduced astringency of the ripe arecanuts.

Fibre content increases with maturity but the increase is particularly significant from second stage to ripe arecanut. As a result of this, the concentration of polysaccharide matter and fat, whose formation continues till the end, is significantly affected after the second stage. Mineral matter decreased with formation of other constituents.

Ripe arecanuts are consumed raw, in which case storage for off-season becomes a difficult problem. In the case of steeping which is the most widely used method of storing, certain modified techniques have been employed by an initial blanching and the use of preservatives such as metabisulphite and benzoic acid in the steeping liquor. Processing of tender arecanuts involves cutting, boiling with water, coating with a concentrate of the extract and drying. During boiling, some amount of polyphenolic matter will be extracted and hence the astringency will be reduced. During many of the heat treatments, polyphenols are likely to get condensed or polymerised which also affects the taste. The results of a field study on the changes in the constituents during processing and of the final product showed that 'tannins' are extracted to varying degrees depending on nature of cut and repetition of boiling, and the final product is not uniform. There is not much change in the alkaloidal content after processing. 'Kali', a concentrate of the arecanut extract is also used for coating in some trade varieties. Different samples showing the same 'tannin' content vary in taste characteristics since the method of analysis does not differentiate between free polyphenols and condensed polyphenols.

The points raised during the discussion related to whether dried arecanuts when soaked in water behave like tender ones, nature of mineral matter in the ash, influence of the method of preserving nuts on the composition of the kernel, relation between price index and chemical composition, whether tannin is present in the outer husk, use of husk for making boards, nature

of 'Kali' coating and use of excess 'Kali', quantity of arecanut that can be safely used by an adult, common adulterants of arecanut, nature of pigments in the husk, whether tannins possess any antibiotic property, possible influence of alkaloid content on stimulating action, percentage of spoilage of arecanuts from the tender to the ripe stage, whether arecanut tannins have any beneficial effect on dysentery as observed with tea tannins, whether the physiological action of arecoline is synergised by the tannins or whether the tannins also have physiological effect, etc.

Answering the queries, the speakers said that the composition of ripe dry arecanut is different from that of the tender nuts. No full assessment of spoilage is available except a figure of about 30 per cent spoilage in Assam region. Preservation for over 6 months by the method developed has not shown any great difference in the main constituents. Good hard-boards have been made out of the husk; the economics of it has still to be worked out. Excess 'Kali' has been found useful for tanning of hides and is being used for coating the adulterants of arecanut such as sago palm nut, tapioca and sweet potato. The husk pigment at the ripe stage consists of β -carotene and xanthophylls. While the physiological action of arecoline is well known, the action of the constituent polyphenols has not been studied so far. The pronounced physiological action of the tender nuts which contain more 'tannins' and less total alkaloids compared to ripe nuts would indicate that the plant polyphenols of arecanut also contribute to the physiological effect. This aspect is now under study.

The President, in his concluding remarks, said that the tradition of *pan*-chewing started in our country and we had already a wealth of experience and literature on the subject. Chewing has an overall pleasant effect and is known to be least harmful. He emphasized the need for doing more work to elucidate the combined as well as

individual effects of arecanut, betel leaf and lime. He said that divergent figures were given for the arecoline content of arecanut. He stressed the importance of close collaboration between the pharmacologist and organic chemist to understand clearly the nature of physiological action of arecanut. He mentioned that the pronounced action of the extractives of tender arecanut could be studied for incorporation with liquors so that the resulting product could be exported. 'Kali' liquor indirectly helps the easy adulteration of the nut. He concluded by saying that immediate attention should be paid to prevent the heavy spoilage of arecanut which would reduce the import of this commodity.

S (IS) 25

Investigations on the preparation of foam heading, by S. Ranganna and M. V. Sastry (October 18, 1960).—Introducing the subject, Mr M. V. Sastry pointed out that foam heading was used to produce a lasting foam in carbonated beverages. He referred to the analysis of commercial samples which contain primarily saponin to the extent of 5-10 per cent in the formulation. Saponins from Quilaja bark is commonly used for the purpose. Since this is not available in India, investigations were carried out to prepare a formulation from the pericarp of the soap berry.

By extracting the rind thrice with five times its weight of boiling water, practically all the saponin could be recovered. When the pericarp was boiled, there was profuse foaming. To overcome this drawback, extraction with alcohol of different concentrations was tried. Saponin content in the extract increased with progressive dilution of the extracting alcohol. With decreasing concentrations of alcohol, sugar and other water-soluble constituents also were extracted besides saponin. Extraction by maceration as well as Soxhlet extraction also were studied.

Formulations prepared from the above extracts were highly viscous

and deep brown in colour. Purification of saponin by adsorption on carbon and subsequent elution with suitable solvents like methanol was then tried. In the formulation prepared by this procedure, the viscosity was reduced and the colour also improved but the stability of the foam produced was comparatively poor. In both the formulations, there was precipitation of saponin during storage.

Presenting the results of further investigations carried out, Mr Ranganna pointed out that the precipitation which was due to partial hydrolysis of saponin could be prevented by incorporation of 40 per cent alcohol in the formulation which, however, would cause certain practical difficulties. Incorporation of additives like dextrin, gums, pectin, alginates, carboxy methyl cellulose, protein hydrolysates, surface active agents, etc., did not improve the stability of foam produced by saponin. Moreover, the foam stabilizing property of saponin varied considerably with the source.

The defects mentioned earlier have been overcome in the process subsequently developed. The essential steps in the process are: extraction with water, filtration, concentration, precipitation of gums and similar materials with alcohol, distillation of the alcoholic extract and making the formulation from the syrupy concentrate obtained after distillation. The filtrate should be concentrated up to 70 per cent soluble solids and the concentration of alcohol in the extract should be 80-83 per cent. The formulation prepared is slightly brown in colour but has good foam-stabilizing property and further there is no sedimentation during storage.

Treatment of the alcoholic extract with activated carbon in order to improve the colour resulted in precipitation in the formulation. Although initially it was found to be caused by changes in pH, washing of the carbon with water or alcohol before use prevented changes in pH. The precipitation was not immediate

but gradual only. Use of animal charcoal instead of vegetable carbon did not overcome this defect.

Several purification procedures were then adopted to prepare saponin in pure form. Precipitation of saponin either from the water extract or after diluting the concentrate at pH 1.5 and heating, resulted in the hydrolysis of saponin. The precipitate was sapogenin and not saponin. Adjusting the pH of the alcoholic extract with oxalic acid resulted in a precipitate which failed to answer the characteristic tests for saponin.

Precipitation with different solvents indicated that saponins of soapberry pericarp consists of two fractions, *viz.*, acetone precipitable and acetone soluble. The former has about 2.3 per cent sapogenin, 62 per cent sugars and is precipitated by basic lead acetate, while the latter has about 32 per cent sapogenin, 52 per cent sugars and is not precipitated by basic lead acetate. The stability of the foam produced by the former is much less than that produced by the latter. Ether precipitates both the fractions. Out of the 63 per cent solids extractable with alcohol from the pericarp, ether precipitates 61 per cent. The remaining soluble fraction (about 2 per cent) contains saponin. Although the pericarp contains 5-6 per cent of free sugars apart from the glycoside sugars, it is only about 3.5 per cent in the concentrate got after distillation of alcohol indicating the high purity of the concentrate. The concentrate could be dried in a vacuum shelf-dryer and then powdered, the yield being 30-33 per cent on the basis of whole nut. The lower yields reported by some of the earlier workers by extraction with ethyl acetate or by salting out with ammonium sulphate or by purifying by precipitation with lead acetate might be due to their taking into consideration one fraction only.

The material and manufacturing cost of saponin per lb. works out to about Rs 2 when the market price

of soapberry is about Rs 8 per 24 lb. Overhead and other charges will, however, have to be added to this. The final cost shall be much less than the present ruling price for saponin.

The process developed for the extraction of saponin from soapberry was applicable in the case of *shikakai* also. The yield of the dried powder was 20 per cent which is considerably more than the reported yield of 8 to 9 per cent.

As regards the toxicological aspects, when taken orally by warm-blooded animals, saponins are relatively harmless as they are broken down by digestive enzymes. Further, the quantities used are quite small (50-100 mg./litre). According to Kofler, a single daily dose of 4.0 g. is not injurious to man. There should, therefore, be no objection to the use of foam-heading concentrates prepared from soapberries.

The points raised during the discussion were: comparative stability of the foam produced by the laboratory and commercial formulations, advisability of using the formulation as saponin is not a permitted additive, need for working out commercial cost, possibility of using long tube evaporators for concentration, position regarding the use of saponins in the soft drink industry, whether any stabilizer or booster was tried, use of dialysis for purification, possible uses of the seed and need for rechecking the purification procedure with lead acetate.

Answering the questions, the speakers said that the stability of the foam produced by the laboratory formulation was quite comparable to that of commercial brands. Regarding the cost, it was stated that the present process should form part of an established industrial unit so that overhead and other charges are reduced. At present, foam-headings are imported and the present investigation was undertaken at the instance of the industry. Polyphosphates, lecithin, etc., were tried but did

not help in stabilizing or boosting the foam. The kernel of the soapberry seed contains about 40-45 per cent oil which could be used in the manufacture of paints and varnishes.

Winding up the discussion, the

President stressed the need for studying the toxicity and permissibility aspects. The formulation could also be used in other fields such as insecticides, printing ink, etc. He felt that the cost of soapberry given by the speaker was

quite high as it could be easily grown anywhere. It was necessary to find out the possible applications of the formulation and saponin. He concluded by saying that the powder could be prepared on large scale and sent to a few industries for trials.

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Processing of arecanuts

E(AT) 83

Would you kindly provide us with some information on the method of processing tender arecanuts? (Cachar District).

The processing of tender arecanut is quite common in Kerala, Mysore and Madras. The cutting into different shapes for making different trade types is done by hand with iron knives and except for copper pans and bamboo ladles no other equipment is required. The processing is as follows:

The tender arecanuts are cut in different size and shape according to the market requirements. They are then put in boiling water for periods varying from 10 to 30 minutes depending on the fineness of the cut (about 18 gallons for 100 lb.). Usually two or three batches of cut arecanuts are boiled with the same quantity of water. This is to economise on water and heating as also to get a sufficiently thick extract which is later concentrated to a thick dark liquor known as 'Kali' or 'Chogaru'. The boiled arecanuts are then laddled out and coated with 'Kali' made from a previous boiling. The amount of 'Kali' used is dependent upon the requirement of different varieties in market. Double coating and

triple coating are also done in some cases. The 'Kali' will give to the product a dark red brown appearance and a good shine. Finally the product is either dried in the sun or during rainy season in country ovens.

Composition of corn oil

E(IS) 84

I request you to kindly enlighten me on the nutritional value and edibility of corn oil. (Baroda).

The characteristics and the fatty acid composition of corn oil as reported in the literature are as follows:

Iodine value	...	125
Refractive index at 60°C	...	1.4596
Saponification value	...	191
Palmitic acid	...	6%
Stearic acid	...	2%
Arachidic acid	...	1%
Oleic acid	...	37%
Linoleic acid	...	54%

Corn oil is characteristically somewhat dark in colour. It is a natural winter oil and most of the corn oil produced in the U.S. is sold as salad oil. As such, there need be no doubt regarding the edibility of the oil.

Vanilla essence

E(IS) 85

I am promoting cottage industries in the different States of India.

Some of our people would like to make vanilla. I shall therefore appreciate if you would suggest the method of extraction of essence from vanilla beans. (Poona).

For the extraction of essence from vanilla beans, non-alcoholic solvents like Carbitol or Solvohol-B can be used. The beans are cut into pieces, bruised and macerated. The macerated beans are then percolated with 65 per cent Carbitol. Frequently, sugar or glycerol is added during percolation to get thicker extracts. The extracts can be used for flavouring foodstuffs. Carbitol is nothing but diethyleneglycol monoethyl ether.

Propylene glycol may also be used as a solvent but this introduces a disagreeable after-taste which is distinctly noticeable even with a small quantity, added as vanilla flavouring. Moreover, propylene glycol fails to extract all of the delicate flavour from the vanilla pods.

Storage of dehydrated bananas

E(IS) 86

I have kept with success well-dried bananas in honey for over two years. Can we replace honey with sugar syrup and can a film of the thick syrup coated on the dried bananas help to keep the product for a long period? (Chickmagalur District).

It is obvious that any material kept in honey can be stored in good condition for a long period, as honey is a thick syrup (nearly 80 per cent concentration) of the sugars, namely, glucose and fructose. Honey can be conveniently replaced by cane sugar syrup of the same concentration with equal beneficial results.

We may state here that dried or dehydrated bananas, if properly wrapped and stored in suitable containers, can keep for a fairly long time without difficulty. This is because of the low moisture content of the dried product. There is no need to keep the dried or dehydrated bananas in honey or sugar syrup as this will only increase the cost of the product. The procedure may be followed on home scale and the honey or syrup can be repeatedly used for the purpose. It will not however be workable on commercial scale.

Bitterness in canned custard apple

E (F) 87

I find that canned custard apple is invariably bitter in taste. I shall appreciate if you can suggest to me the cause for this bitterness and how it can be eliminated to yield a good product. (Hyderabad-Dn.)

The investigations carried out by us show that bitterness in the canned custard apple pulp is due to the presence of alkaloid in combination with other components. It appears only when the pulp exceeds a temperature of 65°C and can be eliminated by controlled conditions, i.e., heating the pulp carefully to a temperature of 65°C and filling into plain tin cans at this temperature; exhausting the cans to a centre temperature of 60–65°C and finally processing it at a temperature not exceeding 65°C for one hour. It is, however, necessary to acidify the pulp with citric acid to lower the pH, which is generally rather high.

Parboiling of paddy

E (BQ) 88

We learn that you have developed an improved method of parboiling of paddy. Could you please write to us the details of the new process so that we could adopt it with benefit in our rice mill? (Calcutta).

The particular aspect regarding the parboiling of rice which has been engaging the attention of this Institute concerns the production of good quality parboiled rice free from all objectionable smell. In the customary methods of manufacture, the paddy is either soaked in cold water for 2 to 3 days or in warm water at about 40°C (as in your double boiling or *Do-bamp* method) for 12 to 24 hours. The soaking of paddy is done in large cement tanks while the steaming is done in batches in small iron kettles. In the improved method developed in this Institute the soaking of the paddy is done for 3 to 4 hours only at a temperature of 70–75°C. The soaking and the steaming are also done in the same tank as the soaking tank itself is provided with steaming coils. This modification of the process completely eliminates the smell and also effects saving in processing time and in labour charges so that the improved method is more economical than the customary method. The yield of rice from parboiling is also not adversely affected in the modified method. Two rice mills in Mysore City and one in Bombay State have already put up new parboiling units according to our design for the commercial production of parboiled rice. Other aspects of the parboiling process relating to milling, drying, etc., remain the same.

Refrigerated storage of potatoes

E (S) 89

We are storing potatoes in our cold storage rooms and sometimes we find the tubers sprouting. Will you advise us on the ideal conditions under

which potatoes can be cold-stored without any injury or sprouting? (Howrah).

The sprouting of potatoes is due to higher temperatures in places of storage. The optimum condition for the storage of potatoes is 35–38°F, with a relative humidity of 85–90 per cent. If the temperature goes below 35°F, there will be low temperature injury in the potatoes which will be exhibited by mould attack and black rot. Usually, sprouting should not be allowed to develop; otherwise weight loss will be tremendous and the germination percentage will go down. Besides, if they are to be used for table purposes, they will become unmarketable.

Jujubes from tamarind seed jellose

E (IS) 90

Kindly furnish us the details of the method of preparation of jujube candy from tamarind seeds. (Trichur).

Jujubes available in the market are mostly gelatine-based and are, therefore, unacceptable to the vegetarians. Jellose, a constituent of tamarind seed, can be used in place of gelatine. The details of the preparation of jujubes from tamarind seed are as follows:

The crushed tamarind seed kernels (0.5 kg.; 1.1 lb.) are boiled with water (25 litres; 5.6 gal.) for about 1 hour with frequent stirring in a stainless steel beaker of about 45 litres (10 gal.) capacity (diam. 50 cm.; height 25 cm.). The contents are then discharged into a long stainless steel beaker (diam. 25 cm.; height 75 cm.). After leaving the mixture overnight, the supernatant liquor is siphoned or carefully decanted, without disturbing the sediment at the bottom, into another stainless steel beaker of about 25 litres capacity, and filtered into the original stainless steel beaker of 45 litres capacity, through a bag filter made of heavy canvas or felt or even thick cloth. To the clear extract (c. 20 litres), sugar (19 kg.; 42.2 lb.) and a

suitable dye (6-7 g.) are added and the mixture boiled while stirring. If an acid taste is desired, citric acid (up to 225 g.; 0.5 lb.) is also added. During boiling the juice is skimmed in order to remove the coagulated material, if any. The mixture is further concentrated to 65-70° Brix. The boiling point of the jelly solution gives a fairly accurate measure of its density. If the boiling point is 5°C above the boiling point of water at the atmospheric pressure it corresponds to the density range of 65-70° Brix. The boiling point is noted with the help of a jelly or any other suitable thermometer. After the heating is over, a suitable flavouring agent (30 g.; a little more than an ounce) is mixed with the jelly solution, which is then transferred into glass, aluminium or stainless steel troughs or trays and allowed to set in a cool place, in thin layers and when kept in refrigerators, setting takes place in 2-3 hours; otherwise the concentrate may be left overnight for the jellification to take place. The weight of the jelly obtained is c. 23.5 kg. (c. 52 lb.).

The jellose liquor obtained normally contains about 1.25 per cent of jellose. But if the concentration is different (which can be estimated by precipitating the jellose from an aliquot part of the extract by means of alcohol and weighing it after drying), the amount of sugar to be added is adjusted so that about 68 parts of it are used for every part of jellose present.

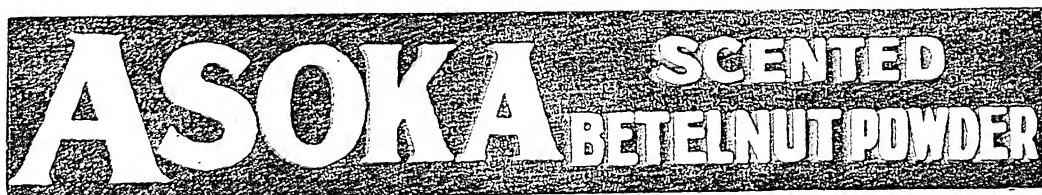
Preparation of jujubes: The jelly is cut with a jelly knife first into slabs of 1-1.5 cm. thickness and finally into cubes or blocks of any suitable shape and size. The jelly pieces are spread in trays with perforated or wire-netted bottoms, dipped into 1 per cent solution of *babul* gum contained in another bigger tray, strained and dried in the sun for 2 days. In the absence of proper sun, drying can be done in an air-oven at 40-45°C. During the course of drying the jelly pieces lose a further quantity of water. They are then rolled in crystalline sugar which forms a coating on the surface. After about a week, they are rolled once again in sugar and then in cornflour and packed in alkathene bags which

are subsequently sealed. The amount of sugar required for surface adherence depends on the size of the jelly pieces and, for pieces of the dimensions mentioned above, about 2 kg. of sugar are normally required for the charge taken in the present experiment. Cornflour treatment prevents the individual pieces from sticking to one another and about 250 g. of cornflour are enough for the charge processed. The weight of the final product is about 25 kg.

These jujubes are quite stable, retaining their shape and texture even during the hottest part of the north Indian summer. The best seasons for preparing them are winter and summer. During rainy season, it is difficult to get enough sun for drying them and even those prepared by making use of air-ovens for drying show a tendency to absorb water from the highly humid atmosphere, become soft and sticky and finally liquefy.

Tamarind seed being an inexpensive commodity, the cost of production is mainly contributed by sugar and it works out cheaper than the current price of gelatine-based jujubes.

Chewer's favourite



Manufacturers: M. K. Krishna Chetty, Post Box No. 106, Coimbatore

Notes and News

NEWS BRIEFS

Test tube protein: The problem of joining up amino acids chemically into proteins has been solved in a new manner. A peptide is used as a starting material in most methods of synthesis of oxytocin, a hormone of the pituitary gland. But the new experiments, aimed not simply at a better way to make oxytocin but rather towards finding a way of building up long chains from amino acids in a chosen sequence, have succeeded in doing so using a single amino acid to start with.

The process involves many chemical steps and the necessity of maintaining between amino acids the same 'twist' (as shown by the effect on polarized light); the molecules are only biologically active with the correct 'twist' throughout. After many trials it turns out that the best procedure is to convert the acid group of the 'growing' end of the chain into the nitrophenylester. This is made to react with the amino acid which is next to be joined; the compound formed is in turn converted to the corresponding ester, the next amino acid added, and so on. In this way a peptide chain can be built up and lengthened, one amino acid at a time, until the desired protein has been synthesized (*J. & Proc. Inst. Chem.*, July 1960, p. 195).

Cold storage boxes without refrigeration: Extraordinary cold keeping efficiency is reported by Glo-Brite Foam Plastic Products for its new five cubic foot plastic foam portable *Freez/Safe* for holding samples at refrigeration temperatures in the plant, for using as an 'island' display and merchandiser for dairy products sale in supermarkets, or for carrying dairy products, such as butter or even ice-cream at refrigeration temperatures on retail sales routes—all without any refrigeration. Tests carried out by an independent laboratory on the *Freez/Safe* model 50, for example, revealed that even ice-cream previously

brought to a temperature of -10°F ., could be held in 85°F . outdoor temperatures for a period of 8 hours with a temperature rise in the ice-cream of only 4.1°F . This same ice-cream still tested one degree below zero after being held 18 hours in the insulated box, again without any supplementary refrigeration. Foam insulation core of this unit is one of the largest moulded units of its kind ever made, being of one-piece construction and weighing only 12 pounds. Expanded polystyrene foam insulation walls, top and bottom are $2\frac{1}{2}$ inches thick. Outside measurements of the insulated box are 28 inches by 19 inches by 28 inches. The foam insulation, equivalent to 4 inches of cork weighs only one-fifth that of cork (*Indian Dairyman*, August 1960, p. 224).

Antibiotics on fresh fish approved: The U.S. Food and Drug Administration have authorized the use of aureomycin (chlorotetracycline) prepared by the American Cyanamid Corp. under the name Acronize for preserving fish. The antibiotic is applied to fish at sea by packing the fish in treated ice. It should be stressed that it merely retards bacterial action and does not replace freezing or sterilization. An additional advantage is that the antibiotic is not destroyed in freezing and will act again after defreezing.

A maximum of 5 ppm is permitted on unprocessed fish (*Food Technol. Austr.*, June 1960, p. 348).

New annatto food colour: An annatto food colour with certain unique properties of particular interest to process cheese-makers has been introduced by Chr. Hansen's Laboratory, Wisconsin. The new product—called Hansen's A-500 Natural Vegetable Food Colour—is a pure extract of annatto seed in a vegetable oil base. Because it is oil-soluble, A-500 is ideal as a colouring agent for process cheese as well as for shortenings, salad oils, bakery goods or wherever

else an oil-soluble colour may be used. It imparts a yellow or orange-red hue, depending upon the product with which it is used and amount of the colour introduced.

The manufacturer claims that it is the most stable carotenoid to light and heat; that it will not cause pinking—a colouring defect attributed to water-soluble annatto colour; and that it compares favourably as a colorant with coal-tar yellows No. 3 and No. 4, which, according to a government ruling are no longer certifiable. Further, it is asserted that A-500 costs less than most other commercially used food colours now on the market (*Indian Dairyman*, July 1960, p. 195).

Metallic contamination and its effect on flavour of canned products: Tests have been carried out to find the metal content of canned packs for use in or after the second year of storage. The low acid packs tested were green peas, beans, asparagus and carrots. As acid packs, pears, plums and prunes were chosen and investigated after 5 years' shelf life.

Non-lacquered tinplate containers were chosen for the less acid packs. Lacquered tinplate containers were chosen for the more acid packs.

In the case of vegetable packs, some of which, as, e.g., beans and carrots, dissolve appreciable quantities of tin, the tin does not affect flavour. Larger quantities of absorbed tin cause deterioration of flavour (metallic taste) in coloured fruit packs. The authors suppose that it is connected with the formation of chelates from the tin and phenolic hydroxyl groups of colouring matters, tannins and other polyphenols. If during comparatively long storage in blackplate containers larger quantities of iron are absorbed by the same fruit packs, the iron does not lead to a metallic flavour. Tin and iron dissolved out of the container show different behaviour with regard to the can content. Whilst tin largely disappears from

the brine and accumulates in the pack through chemical linkage, iron becomes evenly distributed between brine and pack. It proved possible to give a chemical interpretation of this different behaviour of the two metals (*Food Technol. Austr.*, August 1960, p. 419).

Viscometry by direct comparison: It is often necessary to measure the consistency of liquid materials such as paints, oils, cosmetics, and foodstuffs during manufacture. Although the viscosity of a liquid may be measured with existing instruments, there is a need for a simple, robust instrument for rapid process control testing.

An instrument which compares the viscosity of one liquid with that of another has been developed by Mr W. A. Caw of the C.S.I.R.O. Division of Physics, University Grounds, Sydney. It is similar to a simple chemical balance carrying two flat vertical plates in place of the usual pans. One plate is dipped in the liquid to be tested and the other in a liquid of known viscosity. When the plates are withdrawn from the liquids simultaneously, the balance gives a direct reading of the ratio of the weights of liquid adhering to the plates. This ratio remains constant as the liquids drain from the plates and is a measure of the ratio of the viscosities of the two liquids.

The prototype instrument has been used successfully by several manufacturers (*Food Technol. Austr.* August 1960, p. 456).

Collapsible polyethylene tube as a food package: Raspberry jam, grape jelly, honey, peanut butter and creamery butter were used in a series of storage studies to evaluate lined (*i.e.*, coated with polyvinylidene chloride resin) and unlined collapsible polyethylene tubes as food containers. Lined tubes were found to be more suitable than unlined tubes because of a lesser tendency to produce off-flavours and because of their impermeability to oils. During comparative tests at 100°F the storage

life of jam, jelly and honey in lined tubes was generally comparable to that in bottles or cans for periods up to three months (*Food Technol. Austr.*, August 1960, p. 480).

Meat flavour improver: A research chemist has forecast development of a chemical powder which, sprinkled on tough steaks and other beef cuts, would make them tender and flavoursome.

The chemist, Mr. O. F. Batzer, of the University of Chicago, told the 137th national meeting of the American Chemical Society that he and several colleagues had succeeded in isolating two of the chemical constituents of beet muscle tissue which were 'associated for the distinctive flavour and odour associated with cooked beef'.

He forecast ultimate success in isolating the whole complex, then synthesizing it artificially to sprinkle on meat like a condiment (*Food Technol. Austr.*, August 1960, p. 483).

Pink grapefruit juice: Naturally coloured, single strength canned juice from red grapefruit has been prepared by adding to the juice some of the colour-bearing pulp which is normally removed. This pulp-fortified juice has a higher carotene content and does not show muddiness or browning, characteristic of juice made from coloured grapefruit by conventional methods. To obviate the difficulty of non-uniformity in the fresh fruit colour throughout the processing season, canning or freezing pulp from the richly coloured early-season fruits has been suggested so that it could be added to the juice of poorly coloured, late-season fruits. The dark coloured fruits contain more of the bitter principle, naringin. The pulp can, however, be debittered by treating with the enzyme, naringinase. The naturally coloured, pulp-fortified grapefruit juice is organoleptically good and retains good colour even after one year at room temperature. Slight browning occurs after 1½ years of storage at room temperature. Debittered, pulp-fortified

grapefruit juice is therefore desirable (Abstracted from *Food Proc. & Pack.*, August 1960, p. 287).

Dehydro-frozen apples: Recent studies at the Western Utilisation Research and Development Division of the U.S.D.A., have yielded new information on processing conditions and operations required for the production of dehydro-frozen apples. Attention has been given to the determination of conditions that will permit the use of air at normal ambient humidity in the drying operation.

Earlier investigations had indicated that high humidity drying was necessary. Recent tests show, however, that high quality dehydro-frozen apples of suitably low SO₂ content can be produced without the use of high humidity air. The new method involves through-flow drying of apple wedges and the drying capacity per unit of drying surface is several fold greater than that obtained in cross-flow drying (*Food Proc. & Pack.*, August 1960, p. 298).

A new barrier packaging material: A new barrier packaging material, Metacote, said to be particularly suitable for the packaging of a wide range of powdered and granulated produce, such as ground coffee, soluble coffee powder, fruit drink crystals, milk shake flavouring, chocolate sauce powder, and dehydrated potato is now available from the Plastics Group of the Metal Box Co.

Among the advantages claimed for Metacote are freedom from odour, impermeability to gases, good moisture barrier properties, good fat and oil resistance, and its ability to be heat sealed.

Its odour resistance is particularly important. Not only is the material inherently odour free, but tests made with highly sensitive products (such as icing sugar) are said to have shown no absorption of off-flavour, even when storage trials had taken place with strongly odoured products in close proximity.

Tests have also shown that only a very small drop in moisture barrier properties occurs even when the material is heavily creased (*Food Proc. & Pack.*, August 1960, p. 313).

New insecticide: A new wide range pesticide with unusually good residual qualities is announced by Dow Agrochemicals Ltd. This is 'Nankor', an organo-phosphorus compound that is seven times as safe as DDT, but is effective against species of insects that have developed a resistance to DDT, and the chlorinated insecticides generally, it is reported. The new chemical is eminently suitable for treating refuse tips and containers, food handling and processing plants, meat packing establishments, bakeries, dock-side warehouses and buildings, etc.

The chemical comes in several forms: as Nankor 23 W, a wettable powder containing 25 per cent active ingredient. Nankor 44E an emulsifiable concentrate, as 1.0 per cent aerosols for residual and 0.4 per cent space sprays, and finally as granules or in dust form (5 per cent active ingredient). The wettable powder, the emulsion, the granules or dust are recommended for refuse tips and the like (the latter where water supply is difficult), while general sprays for building interiors, to outside walls, receiving bays, doorways, refuse areas, chocked drains and sewers, behind cabinets, refrigerators stoves, sinks, cracks, crevices, etc., either the emulsion or the wettable powder are suitable.

A half to one per cent Nankor spray will give up to six weeks' control of flies (particularly house and meat flies and their larvae), etc. It is particularly lethal to cockroaches. Nankor does not stain whitewash or paint, and there is no appreciable initial odour, the makers claim.

Flying insects are dealt with by the Nankor aerosol space spray which is available in sizes from 6-12 oz., while a few ounces of sugar added to a spray solution

and applied where flies congregate forms bait. There are no hazards to the operator, but the spray should not be allowed to come into direct contact with food.

Nankor is marketed here by Dow Agrochemicals Limited and in due course the chemical will be manufactured at the company's new factory at King's Lynn, Norfolk (*Food Proc. & Pack.*, August 1960, p. 318).

Detection of foreign fats in cocoa products: Determination of foreign fats in chocolate can be a very complex matter, but by making these 5 tests on the extracted fat, extent of its sophistication can be estimated:

1. Infra-red absorption of non-fractionated fat (this will detect small quantities of hydrogenated fats).

2. Separation of fatty acids of non-fractionated fat, using column chromatography (this will estimate lauric acid content, hence detect coconut fat).

3. Separation of methyl esters of fatty acids of non-fractionated fat by gas chromatography (will detect small amounts of coconut oil, and apparently the vegetable tallow as well).

4. Determination of constants of acetone soluble glycerides by physical and chemical analysis (will detect coconut fat and hydrogenated fats).

5. Chromatography of fatty acid prepared by fractionation from acetone and separated by column chromatography (will detect 'E.K. E.', a cocoa butter substitute prepared by fractionating palm oil, in cocoa butter) (*Food Engng.*, June 1960, p. 89).

Flavours isolated from meats seen aiding space feeding: Aroma-bearing materials in meats may eventually be used to enhance flavour of certain meat cuts, or to impart flavour to food concentrates such as algae for space travel.

Basic research by EURDD scientists showed that the flavour-producing substances of lean beef or pork could be completely removed

by extraction with cold water. They found that the 'meaty' flavour comes from the same compounds (low-molecular-weight polypeptides, carbohydrates, and amino acids) developed by cooking lean portions of both meats.

Compounds that provide distinctive flavours of pork and beef are found in the fatty portions. When heated to the boiling point of water, the compounds from beef fat smelled like apple or deep-fat-fried, and those from pork fat smelled like cheese or fried-bacon (*Food Engng.*, June 1960, p. 89).

New milling technique raises rice value: The USDA scientists have developed an improved technique for milling rice, which has now been tried on commercial scale. Milling trials with more than 150 samples of rice employing the existing rice milling equipment showed that much rice is broken before milling begins and that the greatest amount of breakage during milling mostly occurs in the first and second hullers where the bran is removed from the rice kernel. It has been shown that pre-treatment of brown rice (rice with the bran intact) by steaming it and adding abrasives before the scouring operation, assists in the removal of the bran, thereby decreasing the severity and amount of scouring required. The capacity of the plant is also increased by 20-30 per cent. Application of the improved technique results in less breakage and therefore higher yields of head rice. Temperature and relative humidity in the milling room also affect the yield of head rice, the optimum relative humidity being 70 per cent; 4-6 per cent higher yields were obtained when the relative humidity was changed from 30 to 70 per cent with no change in temperature. The new technique is believed to increase the value of milled rice products by nearly \$2 million annually (Abstracted from *Food Manuf.*, June 1960, p. 248.)

Liquid nitrogen for freezing: Food products frozen at a tempera-

ture below -100°C . can be stored for a long time without refrigeration. Experiments are described in which food products were frozen in liquid nitrogen at -100° to -150°C ; after freezing, the food could be transported, without refrigeration in transit, in isothermal containers for periods of 30 to 40 days. Meat was frozen after being chilled at 0°C for 2 days, fresh fish after 2 days storage on ice. Samples of meat and fish were frozen by immersion in liquid nitrogen at -195°C . Storage of meat at this temperature did not affect the solubility of the meat protein. The hydrophilic properties of meat and fish were almost unaffected. The sarcolemma was not affected by cracks appearing between the muscle fibres. The organoleptic properties of the frozen meat and fish were unaffected (*Food Manuf.*, July 1960, p. 312).

DRAFT INDIAN STANDARDS

Layout of periodicals: The draft Indian Standard Guide for Layout of Periodicals (Revised) [DOC: EC. 2 (46)] specifies the form and presentation of periodicals in respect of essential elements in the layout of volumes, individual issues and cumulative indexes. The purpose of this standard is to enable editors and publishers so to shape the form of their periodical as to facilitate their use by readers and librarians. By following these rules editors and publishers will find that they have also made their own task easier, since the rules make for order and clarity.

This standard was originally published in 1949 under the title 'Practice for Make-Up of Periodicals'. While revising, the Sectional Committee has made full use of the experience gained during the last eleven years of the working of this standard. One of the main modifications made in this revision is to restrict its scope to cover learned periodicals only. Requirements for various other items especially those concerning the cover page and the title page have generally been

relaxed in view of the artistic and aesthetic considerations involved. The occasion has also been utilized in redrafting the standard to conform to the latest ISI practice.

In preparing this standard, care has been taken not to specify requirements which might result in stifling individual initiative, or in impoverishment of production values. Requirements in respect of layout have, therefore, been reduced to a minimum.

The standard will be circulated shortly to interested editors, publishers, printers, and librarians and others for their critical comments and suggestions for improvement.

Copies of the draft standard would be available free on request from the office of the Indian Standards Institution, Manak Bhavan, 9, Mathura Road, New Delhi-1 and from its Branch Offices located at Bombay, Calcutta and Madras (*ISI Press Note No. 348/60*).

INDIAN PATENTS

(A few of the Patent Applications, notified as accepted in Part III—Section 2 of the Gazette of India, August 6-27, 1960 are given below.)

66174. *Process and apparatus for the production of dry powders and concentrates from solutions and suspensions:* The solution or suspension is divided into droplets ($5-2000\mu$) which are contacted with counter-current stream of dry gas at $0-60^{\circ}\text{C}$ for 5-1000 seconds.—Patented by Birs Beteiligungs Und Verwaltungsgesellschaft A.G.

66552. *A process for treating oil-containing animal material such as fish and fish offal:* Mechanically disintegrating fish, treating pulp with enzymes, i.e., substrate of fermented deep culture of lactic acid bacteria and centrifuging oil therefrom.—Patented by H. M. Ehlert and I. H. Mikkelsen.

68113. *Improvements in or relating to the manufacture of cans:* The flange of the can body is provided with undulations substantially evenly spaced therealong to accommo-

date changes formed during scanning.—Patented by the Metal Box Co. Limited.

66825. *Method for preparing improved fungicide:* A phenyl substituted aminoalcohol is reacted with a metal salt.—Patented by Rohin and Hass Company.

67031. *A rice boiling apparatus:* Wherein an inner kettle having small holes made in the bottom plate is fitted in a outer kettle having small clearance on its side periphery.—Patented by M. Kamishima.

67860. *An improved centrifuging machine for manufacture of sugar:* Comprising perforated driven centrifugal cage within outer housing with opening at base having inward rim, pipe for draining molasses, means for feeding drained juice into the cage.—Patented by M. A. Chaudary.

66882. *Improvements in or relating to pesticidal preparations:* Comprises fine solid particles of at least one pesticidal material dispersed in a heavy oil.—The Standardised Disinfectants Company Limited.

67468. *Improvements in or relating to the preparation and isolation of isonicotinic and nicotinic acids from the "betapicolin cut":* Oxidising beta-picoline cut and subjecting pyridine carboxylic acids to fractional crystallization.—Patented by Council of Scientific and Industrial Research.

67512. *Improvements in or relating to cartons:* Lid face is provided with an extension adhesively secured to the outer face of an adjacent side and has an unbounded gripping flange.—Patented by Rec-kitt and Sons Limited.

67546. *Machine for frying grams, peanuts and the like:* A rotatable screw conveyor within a shell for conveying material together with sand, inlet and outlet openings for feeding and discharging said materials and another screw conveyor for returning sand.—Patented by R. S. Pillai.

67724. *Method for activating clay:* By forming an intimate mixture of clay, water and sulphuric

acid and heating it to activate the clay and reduce the water content to a maximum of 10 per cent.—Patented by National Research Council.

68340. *Improvements relating to closures for bottles, jars and the like:* Comprising a cylindrical threaded section adapted to fit the top of a bottle the upper edge of the cylindrical section being turned to form an inwardly disposed lip, the lip being stepped in such fashion that secondary smaller lip is formed raised above the level of the first lip.—Patented by D. G. Swingler.

67821. *A process for the production of fungicides from coal tar:* Chlorinating coal tar oil fractions boiling between 180°C and 360°C.—Patented by Council of Scientific and Industrial Research.

FOREIGN PATENTS

2,919,195. *Fruit juices:* Enriched with casein, milk or soy proteins and non-denatured egg yolk.—Patented by R. J. Block, Minute Maid Corp., N.Y.C. (*Food Engng.*, June 1960, p. 150).

2,916,378. *Making chips:* By cooking corn, cooling, grinding, kneading dough between rollers, cutting, oven drying and fat frying.—Patented by B. H. Kuncce, Fiesta Foods Corp., Phoenix Ariz (*Food Engng.*, June 1960, p. 150).

830,044. *Flaked cereals:* Relates to the preparation of flaked cereals which do not require any further cooking but which when mixed with a hot or cold liquid will produce a thickened porridge: cereal grains, e.g., cut oat or barley grains cooked from 30 to 45 minutes with water and steam under a super-atmospheric pressure of from 0.3 to 4 ats. until they have a moisture content of from 60 to 20 per cent, then dried and rolled to a flake thickness of from 0.1 to 0.25 mm. and then ground. Sugars or malt extracts may be added at the cooking stage to improve the taste or effect colour change, and flavouring agents may also be added.—Patented by N. V. Koninklijke Pellerij,

'Mercurius', V/H Gebroeders Laan (*Food Trade Rev.*, May 1960, p. 90).

832,343. *Chocolate:* To prevent the formation of bloom on the surface of chocolate, the oil-free glycerides of the fatty acids of animal butter fat, combined with a unhydrogenated vegetable fat, e.g., cocoa butter, and a vegetable emulsifying agent, e.g., lecithin, are mixed in the non-aqueous condition, with the chocolate mass, also in the non-aqueous condition, in the proportion of 5 per cent by weight of the total, mass (replacing a like proportion of whatever fat is being employed in the chocolate mix).—Patented by Thorvald Friis —Andersen (*Food Trade Rev.*, June 1960, p. 112).

C.F.T.R.I. NEWS

Manufacture of Infant Food: The process standardised at the Institute for the preparation of

infant food from buffalo milk is now under commercial exploitation at Anand. The plant is run by the Kaira District Co-operative Milk Producers' Union Ltd. and is set up at a cost of Rs. 31 lakhs. It has been designed and installed entirely by the staff of the Kaira Union. The plant was declared open by Shri Morarji Desai, Union Minister for Finance on the 31st October 1960. Sri Manubhai Shah, Union Minister for Industries and Ministers of the Gujarat State Government were also present on the occasion. The Amul plant is licenced to manufacture 2500 tons of Baby Food annually and it will initially be available to trade in Gujarat and Maharashtra States and Delhi city by December 1960. It is expected that Amul Milk Food will save the nation Rs. 1 crore in foreign exchange every year.

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Information from Foreign Journals

THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

GERMAN

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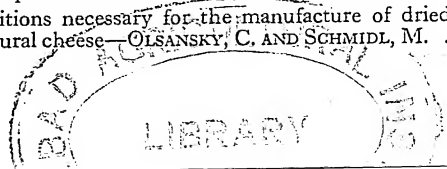
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A G R A

Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Studies on idli fermentation: Part I—Some accompanying changes in the batter, by Desikachar, H. S. R., *et al.*, *J. sci. industr. Res.*, 1960, 19 C (7), 168.

An increase in non-protein nitrogen and a decrease in reducing sugars have been observed during fermentation of *idli* (a popular breakfast dish in South India) batters; the batters are usually prepared by soaking rice (*Oryza sativum*) and decuticled black gram (*Phaseolus mungo*) *dhal* in water, grinding them separately, mixing, and allowing the mixture to ferment overnight. Both titratable acidity and the volume of the batter increase as a result of fermentation and have been used as criteria for judging the progress of fermentation. A temperature range of 25-30°C has been found to be optimal for the fermentation. Temperatures up to 40°C accelerated the rate, but some undesirable smell occasionally developed at higher temperatures.

Presoaking of black gram *dhal*

prior to grinding in the traditional methods has been established to be an important step in the fermentation. The possibilities of a 'Flour Presoaking Method' and a 'Composite Dry Mix Method' for *idli* making to eliminate the need for wet grinding of black gram *dhal* and rice are indicated by the data.

That both yeasts and bacteria participate in the fermentation has been shown using penicillin G and chlortetracyclin as selective inhibitors. Acid and gas production have been found to be mostly dependent on the growth of microbes belonging to the bacterial group.

Hydrolysis of ethylene dibromide by monoethanolamine at ordinary temperatures, by Muthu, M. and Majumdar, S. K., *J. sci. industr. Res.*, 1960, 19 B (7), 273.—Monoethanolamine hydrolysis of ethylene dibromide in gaseous phase has been studied at different temperatures (21-38°C). Ethylene dibromide undergoes complete hydrolysis within 3, 2, 1 and 0.5 hr.

at 21.1°, 25.0°, 31.0° and 37.8°C respectively. The method is useful for the assay of ethylene dibromide from fumigation chambers.

Bioassay of piperazine and some plant products with earthworms, by Krishnakumari, M. K. and Majumdar, S. K., *J. sci. industr. Res.*, 1960, 19 C (8), 202.—A bioassay method for estimating piperazine citrate and other vermicide agents has been reported. Application of the bioassay method, based on the response of earthworms (*Pheretima* sp.) to the drugs in Einger-Locke medium for rapid screening of anthelmintic substances has been demonstrated. Quantitative assessment of different plant drugs for their vermicide potencies has been carried out and their relative efficacies with reference to piperazine citrate have been studied. Piperazine coefficients of papaya seed, mustard seed, garlic and clove show that clove and garlic are superior to piperazine citrate with respect to vermicide potency.

PART II (Indian)

ADULTERATION

Further studies on the detection of metanil yellow in pulses (Dhal), by Mitra S. N. and Roy, B. R., *Sci. & Cult.*, 1960, 25 (9), 539.—Metanil yellow, a non-permissible coal tar dye present in pulses, mainly *arhar* (*Cajanus cajanus*), is detected by extracting the dye in aqueous solution and then subjecting to wool-dyeing as reported earlier. Complete extraction of the dye in aqueous solution is, however, not possible because of the high amount of starch present in the pulses. The present note describes a method of repeated-

ly extracting the dye from half-broken pulse with 80 per cent alcohol, concentrating the combined alcoholic extract to a few drops and subjecting a drop to circular paper chromatography for identifying the dye. The usual wool-dyeing procedure can also be followed with the concentrated dye extract for its detection.

K.L.R.

ANTIOXIDANTS

Paper chromatography of antioxidants: A simple method of identification and separation, by Roy, B. R., Mitra, S. N. and Sen Gupta, P. N., *Curr. Sci.*,

1960, 29 (4), 132.—A rapid and simple chromatographic method has been reported for the identification and separation of antioxidants, *vis.*, BHA, NDGA, BHT and PG. Liquid paraffin is used as the stationary phase while 20 per cent methanol and 5 per cent ethyl acetate have been tried as the mobile phase. The chromatogram, after 4 hours' descending run, is sprayed with the developer, ammoniacal silver nitrate. Black spots are visible within 10 minutes. The R_f values for the different antioxidants spotted individually are given. The R_f values of the antioxidants separated from a mixture of the four

compared well with the values obtained for individual antioxidants

K.L.R.

BIOCHEMISTRY AND NUTRITION

Physico-chemical studies on indigenous seed proteins: Part IV—Peptization of red gram (*Cajanus indicus*) proteins and their characterization by electrophoresis, by Saroj Tawde and Giri, K. V., *J. sci. industr. Res.*, 1960, 19 C (8), 190.—The effect of extraction period and pH of extractant and the influence of various anions, cations and detergents on the solubilization of red gram (*Cajanus indicus*) proteins have been investigated. Electrophoretic analyses of the meal proteins in buffers of varying pH and ionic strength have also been carried out. Maximum separation of the components, one major and two minor, has been found to take place between pH 7 and 8.6 and ionic strength 0.1.

Pattern of food and blood cholesterol, by Shera, K. B., *Curr. Sci.*, 1960, 29 (5), 183.—Total food intake and the amount and nature of fat consumed are known to affect the blood cholesterol level. The present report deals with (1) the effect of two fats, *viz.*, hydrogenated groundnut oil and safflower oil at a medium level of 18 per cent fat calories, (2) the influence of pattern of food in general and cooking in particular and (3) the chronic effect of these fats on blood cholesterol. Army personnel in three groups formed the subjects for the study and repeated blood analysis was made at intervals of 3, 4, 6, 8 and 12 months. Blood cholesterol values have been graphically represented and the inferences drawn from the results given. It is seen that the pattern of food consumed has an influence not only within the groups but also between the groups. The organism adapted itself to different fats at medium levels of intake and no effect on blood cholesterol is seen at low levels. This leads to the conclusion that the hypercho-

lesterolenic action of the fats is due to high intake of fats, at which level the degree of unsaturation has little influence on the blood cholesterol.

K.L.R.

Clinical features of kwashiorkor in Hyderabad, by Rao, G. P., *Indian J. Child Health.*, 1960, 9 (4), 198.—The clinical, biochemical and pathological changes observed in 38 patients suffering from *kwashiorkor* in Hyderabad are reported. The clinical picture of the patients generally conforms to the description of *kwashiorkor* reported in other parts of India as well as the world.

A moderately low incidence of *Ascaris* infestation and the frequent occurrence of severe anaemia (normoblastic bone marrow) are noteworthy features in patients studied.

Treatment of kwashiorkor with vegetable protein diets, by Rao, G. P., *Indian J. Child Health.*, 1960, 9 (4), 207.—The response of three types of diets in the treatment of 38 cases of protein malnutrition is reported. The patients were divided into three groups and were fed respectively skim milk (I), the Indian multipurpose food (formula A) (II) and MPF with injection of 50 mg. of vitamin B₁₂ on alternate days (III) for a period of 30 days. The caloric value of the three therapeutics was adjusted nearly to the same level by using jaggery and bread. The composition as well as the calorie, protein, methionine, cystine, lysine, tryptophan and calcium contents of the diets are given. The results of response show that the time taken for the clinical disappearance of the oedema in patients was 3-16, 2-27 and 4-16 days respectively for skim milk, MPF and MPF plus vitamin B₁₂ diets, the differences being not statistically significant. The total weight gain of the children on the 30th day was also nearly the same. The total serum protein and gain in serum albumin in the three groups ranged from 6.1-6.9 and 1.4-1.8 per cent respectively, the differences being not significant. MPF can therefore serve as a satisfactory and cheap alternative to

skim milk therapy in the treatment of *kwashiorkor*. The significance of the results obtained has been discussed.

K.L.R.

Treatment of kwashiorkor, by Bharucha, P. E. and Edibam, B. C., *Indian J. Child Health.*, 1960, 9 (6), 261.—Twenty-two cases of *kwashiorkor* were admitted for treatment. Alternate cases were given MPF alone and MPF plus *Casilan*. Clinical examination, biochemical studies and biopsies were done on all cases before and after treatment. Serum albumin rose twice as high with MPF plus *Casilan* as with MPF alone, though liver function as judged by the serum cholesterol and γ -globulin showed greater improvement in the MPF group. Liver biopsy, however, showed regression of fatty change in both groups.

CEREALS

Effects of radiations on the nutritive quality of bread wheats, by Sanghi, A. K., Bhatnagar, M. P. and Chandola, R. P., *Curr. Sci.*, 1960, 29 (5), 187.—Radiation treatment of wheat has been found to increase the grain size, weight and colour in the field. The effect of ionizing radiations on the nutritional quality of the grain is reported in this note. Seeds of two varieties of bread wheat treated with different doses, *viz.*, 0.5, 1.5, 4.5 and 13.5×10^{13} np./cm² of pile neutrons have been grown in different plots and the harvested grain has been analysed. Results indicate that protein, carbohydrates, moisture and total ash show significant increase as a result of radiation treatment. The dose of 13.5×10^{13} np./cm² proved lethal in both the varieties. It is, however, to be seen whether the beneficial effect of ionising treatments is permanent by growing the progenies of treated individual plant.

K.L.R.

FRUIT AND VEGETABLE PRODUCTS

Oxalate contents of leafy vegetables, by Anantaswamy, T. S., Kamat, V. N. and Pandya, H. G.,

Curr. Sci., 1960, 29 (4), 133.—The presence of oxalate in plant tissues affects the availability of calcium in the diet by forming insoluble calcium oxalate. As green leafy vegetables have been recommended to overcome the deficiency of calcium in the common Indian diet, analysis of some of the common leafy vegetables has been done for the soluble oxalates, total oxalate and calcium contents. The results show that the total oxalate contents are 2-8 times the amount of calcium in all the vegetables, indicating the unavailability of practically all the calcium. Soluble oxalates account for over 50 per cent of the total oxalates. In view of the wide use of cheap leafy vegetables in the poor Indian diet, the need for taking suitable measures to neutralise the effect of oxalates is suggested.

K.L.R.

Ascorbic acid content of tomato and tree tomato in Darjeeling area, by Sarkar, S. R., *Sci. & Cult.*, 1960, 25 (9), 530.—Tomato and tree tomato at three stages of maturity, *viz.*, green, ripe and about-to-ripen, and grown at different altitudes in and around Darjeeling and also in Sikkim have been analysed for their ascorbic acid content. The results show no definite correlation between the ascorbic acid content and the altitudes at which the fruits are grown. Ascorbic acid increases with maturity in both the fruits. In the case of tomato, however, the vitamin value diminishes slightly at the fully ripe stage after reaching a maximum at the about-to-ripen stage. The values reported here are rather low in the case of tomatoes and higher for tree tomatoes as compared to those reported in Health Bulletin.

K.L.R.

MICROBIOLOGY

Value of pulses as supplements to media in the production of streptomycin, by Narayanan, S. and Iyer, V., *J. sci. industr. Res.*, 1960, 19 C (8), 187.—The effect of supplements prepared from a number of indigenous pulses on the growth, streptomycin production

and sporulation in *Streptomyces griseus* (strains NRRL B-150 and MA-13) in an otherwise defined medium has been studied. Increased streptomycin yields are obtained at a concentration of 0.5 per cent of the powdered pulses. Preparations from germinated pulses are far less effective than the corresponding ungerminated pulse powders, whereas hydrolysates are as effective as the latter. Hydrolysates of black gram (*Phaseolus mungo*) and horse gram (*Dolichos biflorus*) significantly increase streptomycin yields as compared to the corresponding pulse powders. No consistent correlation is observed between streptomycin yield on the one hand and mycelial weight, pH of the culture filtrate or spore count on the other.

OILS AND FATS

Vitamin K and its derivatives as suitable colouring agents for vanaspati, by Sarma, P. S., *Curr. Sci.*, 1960, 29 (6), 221.—The problem of colouring *vanaspati* to help in its easy detection when admixed with *ghee*, has been extensively investigated without satisfactory results. The present report suggests the use of derivatives of vitamin K as colouring agents for *vanaspati*. 10 mg. of a wine-red-coloured compound obtained by treating 'Menaphthone' (synthetic vitamin K) with alumina, when mixed with 100 g. of 'Dalda', gave a light pink colour. Addition of this coloured 'Dalda' to *ghee* at 30 per cent level was detectable by its colour. To detect adulteration even at 10 per cent level, addition of 'acetomenaphthone', the acetyl-derivative of vitamin K, which gives deep red colour with NaOH to *vanaspati* has been tried. 20 mg. of the acetyl-derivative was added to 100 g. of 'Dalda' which was then mixed with *ghee* at 10 per cent level. The adulterated *ghee*, when heated with NaOH for $\frac{1}{2}$ hour on a water bath gave a pink colour. The results indicate the possibility of colouring *vanaspati* with vitamin K derivatives so that adulteration of *ghee* could be

easily detected. Heating the *vanaspati* above 100°C lowers the intensity of the pink colour and the acetomenaphthone-alkali test gives a yellow colour instead of the original pink. The need for using more stable derivatives of vitamin K has therefore been suggested. The derivatives are not removed by treatment with fuller's earth and washing soda.

K.L.R.

GENERAL

Constitution of the leucocyanidin of the groundnut, by Nagarajan, G. R. and Seshadri, T. R., *Curr. Sci.*, 1960, 29 (5), 178.—The pericarp of the groundnut kernels is rich in leucoanthocyanidin and it has been extracted by soaking the whole kernels in cold alcohol. The alcoholic extract is evaporated under reduced pressure, the residue taken in ethyl acetate and purified by fractional precipitation with petroleum ether (40°-60°C.). It has been identified by the usual tests and its constitution established by preparing some of its derivatives and studying their characteristics. It is found that leucocyanidin has a 3:4-diol structure and not a 2:3:4-triol structure as suggested by earlier workers. Its new configuration is also given.

K.L.R.

Brown wrapping papers from arecanut husk, by Singh, J. and Guha, S. R. D., *Res. & Ind.*, 1960, 5 (6), 169.—Arecanut husk, available to the extent of about 10,000 tons in India, is now discarded as a waste material. Proximate chemical analysis of the husk shows it to be a good source of lignin (30 per cent), cellulose (52.3 per cent) and pentosans (20.6 per cent), and as such it can serve as a suitable material for paper pulp. The husk was digested at 170°C for 4 hours by the sulphate process using a material-liquor ratio of 1:6 and 13.5-18.6 per cent chemicals. The yield of the pulp ranges from 40.4 to 57.5 per cent.

Sheets were made from the pulp, dried in air and conditioned at 65 per cent relative humidity and 20°C. The strength properties of the resulting sheets have been

determined. It is found that although the properties are not satisfactory for the production of kraft wrapping paper, they are quite good for making brown wrapping

paper. Addition of bamboo and jute pulps to the arecanut husk pulp improves the strength properties of the sheets.

K.L.R.

PART III (Foreign)

ANALYTICAL

The determination of vitamin B₁₂—a critical review, by Shaw, W. H. C. and Bessel, C. J., *Analyst*, 1960, 85, 389.—The present review covers the following heads: isolation of vitamin B₁₂ in crystalline form, physical and chemical methods for vitamin B₁₂, methods of separation of vitamin B₁₂ from crude materials and from analogues, pharmaceutical preparations containing vitamin B₁₂, microbiological determination of vitamin B₁₂ in natural materials, microbiological assay methods using different test microorganisms, assay with higher animals and clinical assays. Some of the properties of vitamin B₁₂, cobalamines and natural analogues are also given. 174 references.

K.L.R.

Determination of ascorbic acid in highly coloured solutions with N-bromosuccinimide, by Evered, D. F., *Analyst*, 1960, 85, 515.—Estimation of ascorbic acid in dark coloured solutions by the indophenol reduction method is not possible as the pigments interfere with the colour of the indophenol dye both in the direct titration and spectrophotometric methods. The present study deals with the assay of the vitamin by oxidation with N-bromosuccinimide which, unlike 2:6-dichlorophenolindophenol, is unaffected by reductones, reductive acid and iron salts. The procedure consists in diluting the highly coloured solution like blackcurrant juice with 1 per cent (v/v) aqueous acetic acid, adding glacial acetic acid, a known volume of potassium iodide solution and diethyl ether to a small aliquot of the diluted juice taken in a test tube, and titrating the mixture with N-bromosuccinimide

solution from a micro-butette with constant shaking. The first appearance of brown colour of liberated iodine in the ether layer indicates the end point. A blank titration is also carried out. The results show that the method works satisfactorily within the limits of experimental error, the ascorbic acid values determined comparing well with the amounts added to diluted blackcurrant juice. The same procedure is used for standardising the N-bromosuccinimide solution by titrating it against aliquots of standard ascorbic acid solution. For light coloured solutions like orange juice, the usual iodimetric method using starch as indicator can be followed as the colour does not interfere when the juice is suitably diluted.

K.L.R.

The detection and determination of diphenyl and o-phenylphenol in concentrated orange juice by gas chromatography, by Thomas, R., *Analyst*, August 1960, 85, 551.—Chemical methods at present used for determining diphenyl and o-phenylphenol were found to be too slow and insensitive for routine tests on concentrated orange juice. Both compounds can be simultaneously determined in a 1 ml. sample of juice by gas chromatography. The experimental error, at a probability of 95 per cent, is ± 0.4 ppm for diphenyl and 0.4 to 0.8 ppm for o-phenylphenol, both compounds being present in concentrations between 1 and 10 ppm. Both compounds can be determined in about 35 minutes.

BIOCHEMISTRY AND NUTRITION

Evaluation of protein in foods for regulatory purposes, by

Campbell, J. A., *J. agric. Fd. Chem.*, 1960, 8 (4), 323.—The determination of the protein efficiency ratio of individual foods fed at a 10 per cent protein level in a standardized 4-week rat growth assay has been found to be the most generally applicable procedure for evaluating protein quality. Based on the determination of three amino acids, lysine, methionine and cystine, a simplified chemical score was found to correlate well with PER data on a series of 43 foods. The method was rapid and reproducible. To evaluate the protein contribution of different foods for regulatory purposes, a protein rating was developed based on both the quantity and quality of protein in a reasonable daily intake of food. This procedure was applied to a variety of foods and appeared to classify them in a logical manner.

Effect of amino acid supplements, vitamin B₁₂ and buffalo fish on the nutritive value of proteins in sesame seed and meal, by Kik, M. C., *J. agric. Fd. Chem.*, 1960, 8 (4), 327.—A study of sesame seed and meal was undertaken, because of their importance to human nutrition and the animal feed industry. Addition of lysine, lysine and threonine, and buffalo fish benefited growth and the protein efficiency of sesame seed and meal. Sesame meal supplemented milled white corn meal, enriched wheat flour and white milled rice. Lysine and threonine influenced the biological value and net utilization of sesame seed. Vitamin B₁₂ failed to supplement the lysine-threonine additions. Data are presented on amino acid, vitamin, and mineral contents. The nutritive value of sesame seed and meal warrants their use in the enrichment of diets for certain population groups

and for continued use in poultry and swine rations.

Effect of autoclaving on the amino acids and proteins of the chick pea, by Cueto, A. G., Martinez, W. H. and Frampton, V. L., *J. agric. Fd. Chem.*, 1960, 8 (4), 331.—The work reported grew out of an interest in the effects of heat on the nutritive quality of plant proteins. Lysine is the limiting amino acid in most rations in which cereals are the source of energy. Because the chick pea, a typically starchy seed, is rich in lysine and is an important food crop, interest developed in the effects of heat on the nutritive quality of its proteins in comparison with typical oilseeds. About 25 per cent of the chick pea is protein, rich in lysine (6.5 to 6.7 per cent). The lysine content is reduced by about 10 per cent when the seeds are heated in the autoclave to 121°C for 30 and 60 minutes. The reduction is greater the less the moisture content of the seed.

Sequence in which indispensable and dispensable amino acids become limiting for growth of rats fed diets low in fibrin, by Kumta, U. S. and Harper, A. E., *J. Nutr.*, 1960, 71 (3), 310.—The results of growth experiments indicate that in diets containing 6 per cent of fibrin as the only source of protein leucine, isoleucine, valine and histidine are all equally the most limiting amino acids for the growth of the rat; methionine and phenylalanine are equally next limiting; lysine is the third limiting amino acid and threonine, arginine and tryptophan are least limiting.

Diets containing 6 per cent of fibrin supplemented with a mixture of the indispensable amino acids to satisfy the accepted amino acid requirements of the rat do not support optimal growth. Addition of a mixture of dispensable amino acids containing glutamic acid, glycine, aspartic acid and alanine or addition of glutamic acid alone stimulates growth considerably.

Balance studies in malnourished Jamaican infants. I. Absorption and retention of nitrogen and phosphorus, by Waterlow, J. C., and Wills, V. G., *Brit. J. Nutr.*, 1960, 14, (2) 183.—Nitrogen and phosphorus balances were done on thirty-seven severely malnourished babies, of whom five died. All were treated with either a cow's milk mixture or human milk. The results have been analysed in relation to the stage of treatment.

At all stages of treatment over 80 per cent of ingested N was absorbed. The corrected absorption, with allowance for faecal metabolic N, was more than 90 per cent, even in the first days after admission to hospital.

On N intakes up to 0.5 g./kg./day, more than 50 per cent of ingested N was retained. When a correction was applied for endogenous N loss, it was found that N retention progressively fell off as the protein stores were built up.

About two-thirds of ingested P were absorbed. Absorption did not vary with the stage of treatment.

P retention, like N retention, diminished in the later stages of treatment.

In general, more P was retained in relation to N than would be expected from the ratio of these elements in normal muscle. This finding fits in with other evidence of P depletion in these infants. It is suggested that some of the 'extra' P retained may have been taken up by bone.

In the five babies who died, absorption of both N and P was satisfactory. All the subjects were in positive balance for both N and P at the time of death, which suggests that death was not caused by an irreversible failure of N utilization.

Most of the babies who did not die were treated with cow's milk mixtures that supplied only 0.3-0.4 g. N/kg./day. These intakes were lower than those often used for the treatment of protein malnutrition. At this level of protein intake,

N retention and gain in body weight both went on at about three times the rate found in normal infants of the same age. It follows that if such intakes are adequate for repair, they should also be adequate for normal growth and maintenance.

Balance studies in malnourished Jamaican infants. II. Comparison of absorption and retention of nitrogen and phosphorus from human milk and a cow's milk mixture, by Waterlow, J. C. and Wills, V. G., *Brit. J. Nutr.*, 1960, 14 (2), 199.—A comparison has been made in seventeen malnourished infants of the absorption and retention of nitrogen and phosphorus from human milk, and from cow's milk mixtures of equal protein, fat and carbohydrate content.

N absorption was not significantly different with the two types of milk. On human milk 49 per cent of ingested N was retained, compared with 41 per cent of the cow's milk mixtures. This difference was significant.

On both types of milk 70 per cent of ingested P was absorbed. The P content of human milk is only half that of the cow's milk mixtures. The percentage retention of P was therefore greater on human milk, but the absolute amounts of P retained were the same on the two milks.

It is suggested that although the difference in N retention was not very great, it may be of biological significance to infants living on marginal protein intakes, for whom it is of critical importance to achieve the highest possible efficiency of N utilization.

Study of the proteolysis of certain vegetable proteins by papain, by Bahadur, K. and Atreya, B. D., *Enzymologia*, 1960, 22 (2), 137.—Of the vegetable proteins examined, the soluble proteins of *Phaseolus radiants*, *Cajanus indicus* and *Lens esculentum* are broken down by papain within a range of pH 7.09 to 8.08, but the proteolysis of the soluble proteins of *Phaseolus mungo* is maximal only at pH

7.60 and it is very small at other pH.

Within the range of pH 7.09 to 8.08, the mixture containing low concentrations of the above proteins shows greater proteolysis at lower pH values of the mixture and the mixture containing high concentrations of the above proteins show greater proteolysis at higher pH value of the mixture. At a constant pH, greater proteolysis is observed with increase of concentration of the substrate in the mixture, and this is true for almost all the mixtures within the concentration limits examined.

The availability of lysine in groundnut biscuits used in the treatment of kwashiorkor, by Clegg, K. M., *Brit. J. Nutr.*, 1960, 14 (3), 325.—The method of Bruno and Carpenter (1957), which measures 'available lysine' by estimating free-amino groups, was applied to biscuit mixtures that have been used in the treatment of children with kwashiorkor in Uganda.

It was found that the cooking of skim-milk powder with the other ingredients of the mixtures reduced the 'available lysine' by about one-third. The damage was probably caused chiefly by the lactose of the powder.

It is suggested that the results could be correlated with clinical and biochemical findings in children treated with the biscuit mixtures.

DEHYDRATION

A continuous process for dehydrating honey, by Turkot, V. A., Eskew, R. K. and Claffey, J. B., *Food Technol.*, 1960, 14 (8), 387.—A continuous process has been developed on a pilot-plant scale for producing dried honey. The product has colour and flavour quite close to that of the original honey; has free-flowing, granular physical form; and has long shelf life. It can be produced from both table and baking grades of honey, either with or without the addition of sucrose before drying. Addition of sucrose raises the

temperature at which the dried product will soften and makes it more resistant to caking at elevated temperatures. Honey essence of high potency and true aroma character can be obtained as a by-product. Estimated costs of making the dried honey on a commercial scale are presented. The dried honey has applications in commercial baking, in confectionery making and in the production of packaged dry baking mixes.

FISH

The picric acid turbidity test: A possible practical freshness test for iced shrimp, by Kurtzman, C. H. and Snyder, D. G., *Food Technol.*, 1960, 14 (8), 387.—An approach of possible usefulness in developing a satisfactory freshness test for iced shrimp was discovered by chance during the course of a well-known preparatory procedure for the analyses of free amino acids of spoiled and unspoiled shrimp. The procedure consisted of precipitating with 75 per cent ethanol, heating, and adding saturated aqueous picric acid solution to permit the determination of free amino acids, in the clear supernatants obtained after centrifugation. Clear supernatants were derived from unspoiled shrimp; quite turbid supernatants from spoiled shrimp. This observation stimulated study of a procedure, based on this finding that could be used as a freshness test for iced shrimp.

FRUIT AND VEGETABLE PRODUCTS

Organic acids in the apple as related to variety and source, by Kenworthy, A. L. and Harris, N., *Food Technol.*, 1960, 14 (8), 372.—Three apple varieties, McIntosh, Red Delicious and Golden Delicious, were studied in regard to organic acid composition. Two lots of Golden Delicious were used—one from Michigan and one from Washington. The McIntosh, Red Delicious and Golden Delicious samples were from the

same orchard in Michigan. The four lots of apples were compared as to pressure test, soluble solids, per cent dry weight, rate of CO₂ evolution and the per cent of juice. Marked differences in these factors were found and may reflect genetic, or environmental factors which in turn would influence the acid composition. Total acidity was highest for the Michigan Golden Delicious and lowest for the Washington Golden Delicious.

Factors affecting the drained weight and firmness of red tart cherries, by LaBelle, R. L. and Mayer, J. C., *Food Technol.*, 1960, 14 (7), 347.—Factors found to influence the firmness and drained weight of frozen or canned cherries are time elapsed between harvest and packing, degree of bruising, and fruit maturity. Prolonged holding time provides progressively higher character scores and drained weights in the processed products, whereas the ripening of the fruit has opposite effects. Although bruising also tends to augment firmness in the final product, it has the disadvantage of promoting decidedly greater scald. No difference was found between the firming effects of holding in air as compared to soaking in water. Neither were any significant differences in firmness observed when holding or soaking temperatures of 40 and 80°F were compared. The higher temperature merely encouraged scald damage. In general, conditions which favour high drained weight and firmness in red tart cherries are also conducive to scald and adversely affect colour. As a compromise between these two quality objectives, it is suggested that cherries be handled with minimal bruising and be promptly chilled and soaked in cold water for moderate periods of 4 to 10 hours.

Chemical and physical changes in green beans during preparation and processing, by Sistrunk, W. A. and Cain, R. F., *Food Technol.*, 1960, 14 (7), 357.—A study of the effects of size and variety of beans and the tem-

perature and time of blanch on the chemical constituents in blanched and canned beans showed these constituents to be related to texture in the canned beans. Texture was measured by per cent of sloughed skins and resistance to shear. AIS was not correlated with either firmness or sloughing of canned beans. Total and reducing sugars of canned beans reached a minimum when beans were blanched at 150° to 170°F, the temperature range at which the texture was firmest and the percentage of sloughed skins was lowest; yet this relationship was not established at other blanching temperatures. Low starch content was found in this range of blanching temperatures and high starch values in the range of 180° to 200°F. Most texture changes in canned beans appeared to be related to changes in pectic substances during blanching and canning. Resistance to shear increased with an increase in per cent of pectate-pectinates, a highly significant positive correlation that existed in both phases of the experiment. Conversely, percentage of sloughed skins in canned beans was negatively correlated with percentage of pectate-pectinates and alkali-soluble pectins. The resistance to shear of canned beans of individual treatments was greater in the FM-1 strain than Asgrow Regular variety. Furthermore, the skins of the sieve size 5 canned beans of Asgrow Regular sloughed more than FM-1, but the reverse was true in sieve size 1 beans. Blanching at temperatures between 170° and 180° F for a time of 1.5 to 5 minutes was optimum for pole snap beans. Since the percentages of sloughed skins and resistance to shear of canned beans were affected by temperature of blanch, time of blanch, size of beans and variety, optimum blanch was conditioned by these factors. Closer control over the raw material was apparent in order to prevent squeakiness and off-flavour in beans that were under-blanch as well as softness and sloughing in beans that were

over-blanch. Adjustments in temperature of blanch or time of blanch within this temperature range should be sufficient for controlling sloughing and softening in pole snap beans for canning.

Sand in canned strawberries, by Dickinson, D. and Raven, T. W., *Analyst*, 1960, 85, 521.—Strawberries are generally subject to contamination by soil which may leave a residue of sand in the canned product. The present study was made to determine the sand contents of different packs of canned strawberries and correlate it with canning and horticultural practices. The amounts of soil and siliceous matter present on 15 samples of fresh fruits have been determined by washing the fruit and collecting the soil on a tared Whatman No. 42 filter paper which is dried at 100° C and weighed. The effects of washing the fruit with water and placing straw beneath it have also been studied. Several packs of canned strawberries obtained from 14 different canneries have also been analysed for the sand content and the results discussed in relation to the treatment given to the fruit before canning. The fresh fruits are found to contain surprisingly high amounts of soil in them, 98 per cent of which can be easily removed by efficient washing. The washed fruits still contains 30-40 ppm of sand. The average sand content of all cans except those containing excessively dirty fruit is 60 ppm while the value for cans of unwashed strawberries is 220 ppm. Sand contents less than 100 ppm are unlikely to be noticed by the consumer.

K.L.R.

INSECTICIDES

Metabolism of insecticides by various insect species, by Perry, A. S., *J. agric. Fd. Chem.*, 1960, 8(4), 266.—Most chlorinated hydrocarbon insecticides and many organophosphorus compounds are metabolized by insect species. The metabolic processes that bring about these chemical changes may be classified as 'activating' and

'detoxifying'. Activating mechanisms usually involve epoxidation reactions, such as conversion of heptachlor to heptachlor epoxide and aldrin to dieldrin; or oxidation reactions, such as conversion of thionophosphates to phosphates, oxidation of thiol ethers to sulfoxides and sulfones, and oxidation of phosphoramides to more potent cholinesterase inhibitors. Detoxifying processes may convert insecticide to nontoxic metabolites, which are retained in the tissues or rapidly excreted. Detoxication of organophosphorus compounds in most cases involves hydrolytic reactions. The type of change is dependent on the chemical structure of the compound and the insect species—DDT is metabolized by the housefly, body louse, certain mosquitoes, American roach, Mexican bean beetle, boll weevil, milkweed bug, fruit fly, etc., but this process follows four or five metabolic pathways. Many of these reactions are enzymatically catalyzed.

MALTING

Kaffircorn malting and brewing studies. Occurrence of β -amylase in kaffircorn malts, by Novellie, L., *J. Sci. Fd. Agric.*, 1960, 11 (8), 457.—Contrary to commonly accepted views, sorghum (kaffircorn) malts have been found to contain amylase in considerably more than traces, 18-39 per cent of the saccharifying activity being due to the β -amylase. The α - and β -amylases have been found to develop at approximately the same rate during germination. Sorghum β -amylase has been prepared free from the α -enzyme and its properties studied for the first time. Since the β -amylase of sorghum closely resembles those of barley malt and wheat, the low diastatic power of kaffircorn malts compared with those of wheat and barley is attributed only to the lower proportion of β -amylase and not to any fundamental difference in its properties.

Kaffircorn malting and brewing studies. Starch content of

Kaffir beer brewing materials, by Holdt, V. M. M., Brand, J. C., *J. Sci. Fd. Agric.* 1960, **11** (8), 463.—Starch was determined in kaffir beer brewing materials by a modification of the method of MacWilliam *et al.* Kaffircorn grains contained 61.1-69 per cent starch; kaffircorn malts 45.9-61.2 per cent, and maize grits and maize meals 71.8-81.7 per cent. The starch content of the spent grains from different breweries varied widely from 14.7 to 50.3 per cent. In a trial brew, 40.7 per cent of the starch in the raw materials escaped degradation during mashing, 32.8 per cent appearing in the final beer and 7.9 per cent in the spent grains.

Kaffircorn malting and brewing studies. VII.—Changes in the carbohydrates of kaffircorn during malting, by Holdt, V. M. M. and Brand, J. C., *J. Sci. Fd. Agric.*, 1960, **11** (8), 467.—The sugars present in the kaffircorn grain and malt have been identified: glucose, fructose and sucrose are present in the grain, while the malt contains also maltose and lower maltose oligosaccharides. Data are given for the changes occurring in the content of these sugars and starch during germination of the kaffircorn and drying of the malt at 50°C.

MEAT

Effect of cooking and carcasspart on the methionine and cystine content of chicken meat, by Fry, L. J. and Stadelman, W. J., *Food Res.*, 1960, **25** (3), 442.—The present study was initiated (1) to determine the distribution of cystine and methionine in the white meat, dark meat, giblets and skin of poultry meat, (2) to investigate the effect of cooking and (3) the differences in methionine and cystine content of white meat of individual birds.

Cooking was done in a reel type oven at 325° F. Whole birds were baked in a covered container for 1 min. per 10.5 g. of weight, and half birds for 1 min. per 7 gm. of weight. Portions were dried by lyophilisation. Microbiological

assays of six hour acid hydrolysates of chicken meat were used to determine the effect of cooking and individual bird variation on the content of the two amino acids. *Leuconostoc mesenteroides* P-60 ATCC 8042 was the organism used for microbiological analysis.

Methionine and cystine were found to be stable to effects of cooking by baking in a covered container. The reason for significant increases in both amino acids which occurred during cooking has been given. Use of composite samples of birds on the same diet and of the same age has been indicated to be a valid assay technique.

Various segments of chicken carcass differ significantly in their methionine and cystine content, light meat possessing the highest value (2.97 g. per 16.0 g. of nitrogen). Liver contains the largest amount of cystine (2.12 g. per 16.0 g. of nitrogen). Skin was the lowest in both the amino acids.

B.V.S.

PACKAGING

Packaging—1. Packaging materials—A food manufacture survey, by Anon, *Food Manuf.*, 1960, **35** (9), 370.—This is a comprehensive survey of materials for food packaging. Transparent as well as opaque cellulose films, polythene films and bread wraps, aluminium foil, adhesive type, polypropylene, vacuum-formed picks, heat and sealable carton system and polyester films, metallised films, bottle seals and stoppers, overwraps for meat products and papers for packaging have been dealt with and their characteristics and uses discussed.

B.V.S.

Packaging—2. Packaging materials—A food manufacture survey, by Anon, *Food Manuf.*, 1960, **35** (9), 377.—In this special survey, details about a wide range of liquid fillers, use of tubular wrapping machine, check weigher, machines for packing dairy and allied products, vacuum packing, cap lining as well as thermoplastic labelling and stuffer for meat cas-

ings have been given along with photographic reproductions of same machines either new or improved versions of established ones.

B.V.S.

WINES

Effects of sulfur dioxide, temperature, time and closures on the quality of bottled dry white table wines, by Ough, C. S., Roessler, E. B. and Amerine, M. A., *Food Technol.*, 1960, **14** (7), 352.—In wine stored with cork closures, at two sulfur dioxide levels and at temperatures of 32°, 53°, and 70° F the relative free and total sulfur dioxide changed only slightly in a 22-month period. In general, cork closed wines at the lowest storage temperature received the best scores; specifically, the 32° F storage temperature resulted in a significantly better mean score than did the higher temperatures. Wine quality also varied with sulfur dioxide level. Wines stored at the lower sulfur dioxide level (100 mg. per liter) were of significantly better quality than wines stored at the higher level (250 mg. per liter). In general, wine quality deteriorated with time of storage. Sulfur dioxide content at the higher levels declined more rapidly with metal than with cork closures. Storage temperature speeded the decline. Again, time of storage and sulfur dioxide levels caused significant differences in quality. In this experiment no significant effects on wine quality were found from closures or from the three lowest storage temperatures. Storage at 120° F was very detrimental to wine quality in all cases.

YEAST

Absence of toxic effects by food yeast on the rat, by Bender, A. E. and Doell, B. H., *Brit. J. Nutr.*, 1960, **14** (3), 305.—In an attempt to resolve the conflicting reports about the toxicity of yeast to mammals, the AA have conducted investigations to determine whether any harmful effects of food yeast on the rats could be detected. Three varieties of yeast,

Torulopsis utilis, *Zygosaccharomyces lactis* and *Candida arborea*, were used. 144 rats including controls received food yeast at various levels. The basic diet contained 23.5 per cent protein, 3 per cent fat and 5 per cent fibre with 40 ml. milk/week, 0.1 ml. codliver oil four times a week and 0.1 ml. wheat-germ oil once a week. Food yeast was added at levels of 3, 6, 9, 12 or 21 per cent and the animals were given the diet for 4-6 months. Half of them were killed and their organs weighed and examined his-

tologically. The rest were mated and their fertility observed.

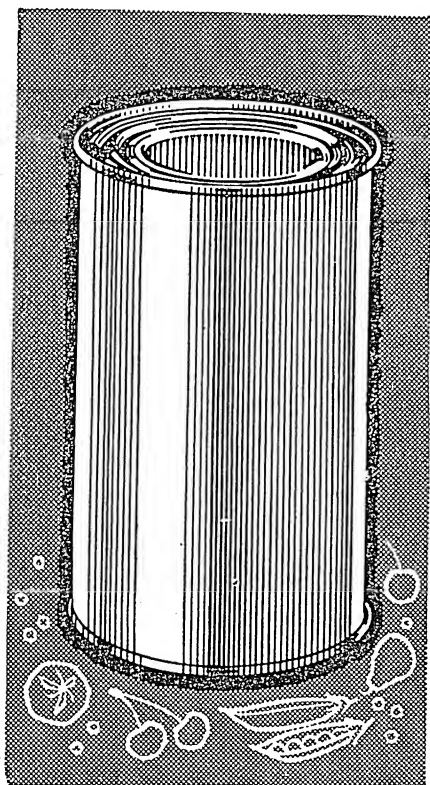
No effects were observed as judged by gain in weight, efficiency of food conversion, overall body and carcass lengths, blood and urine picture, histological picture of liver, spleen, thymus, kidney and adrenals, dry weight and fat content of liver and fertility.

B.V.S.

GENERAL

The variable taste perception of sodium benzoate, by Peryam, D. R., *Food Technol.*, 1960, 14 (8),

383.—The qualitative responses to sodium benzoate (sour, salt, sweet, bitter) vary among individuals but the data derived from this study do not indicate that the responses could be used to classify best populations, as has been maintained. Basic physiological differences among people may partially explain the differences in perception but it is likely that differences among people in learning, verbal habits, and the language used to describe their taste experiences are also involved.



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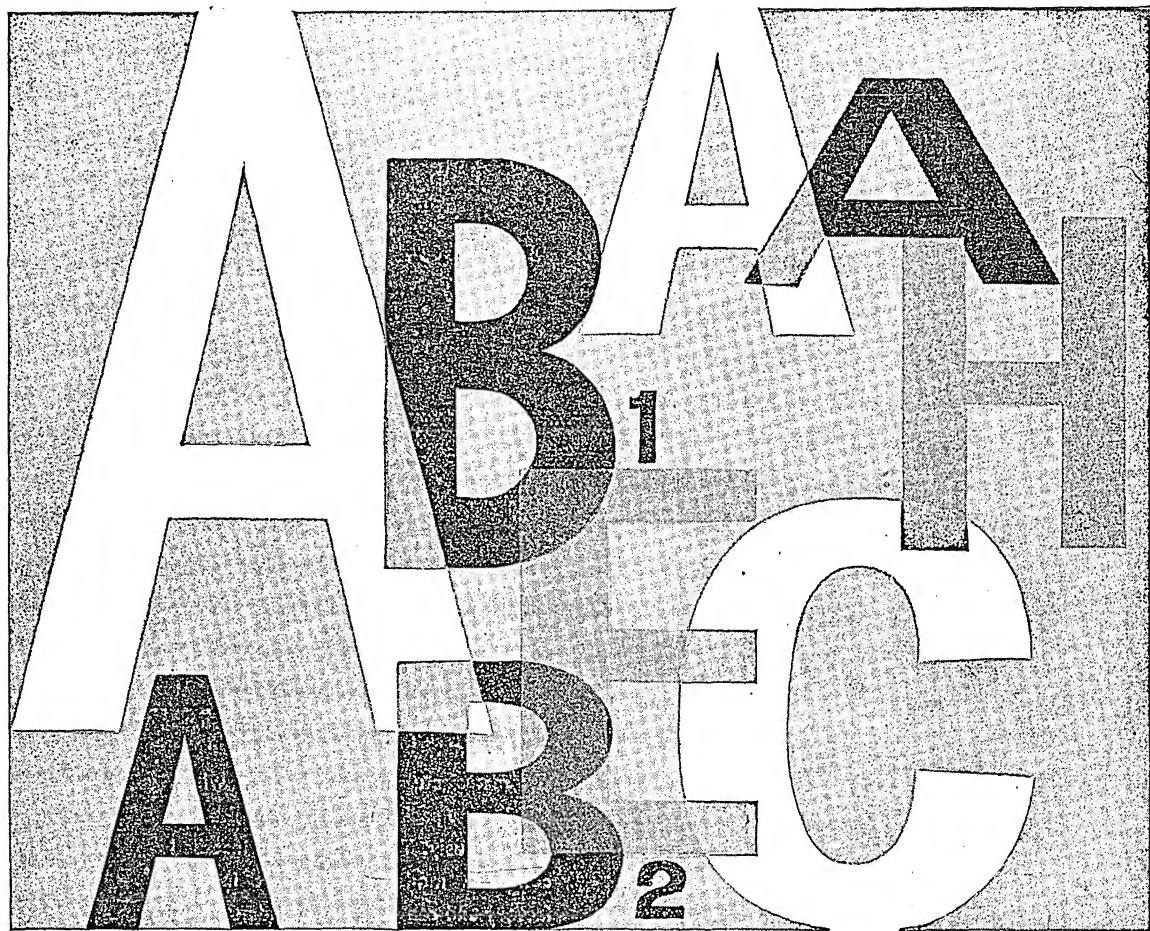
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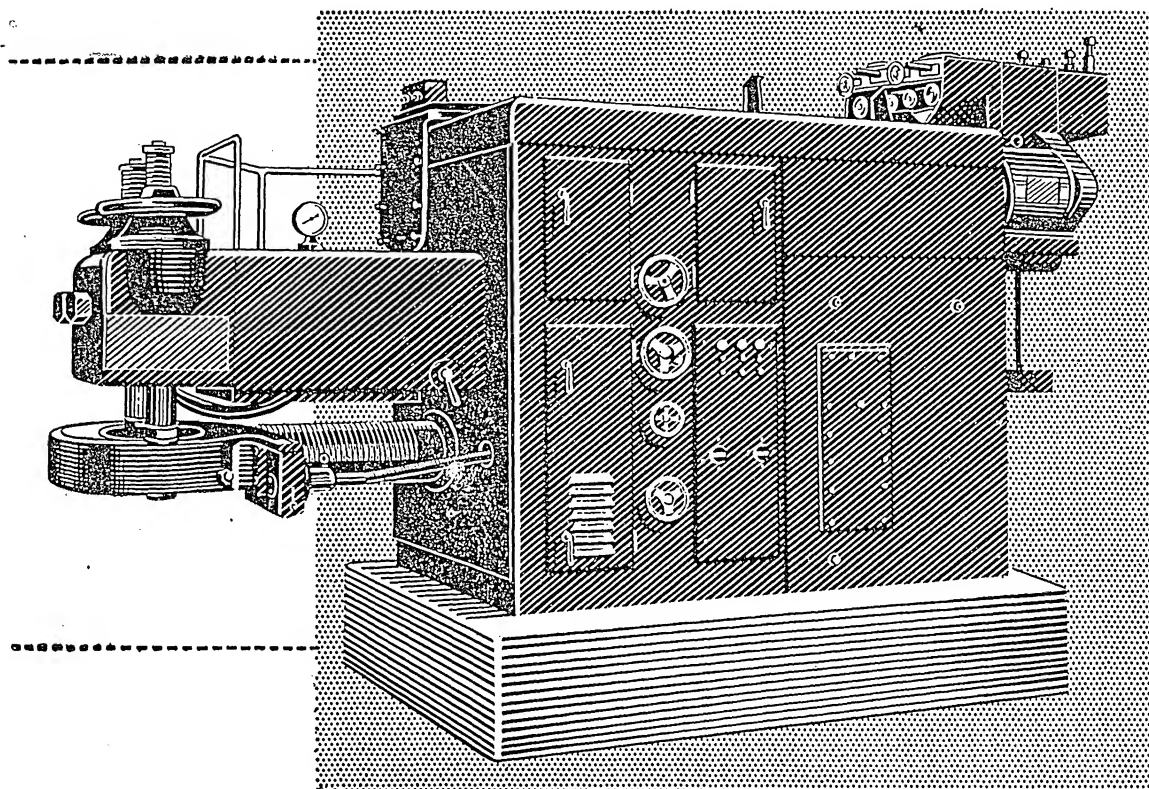
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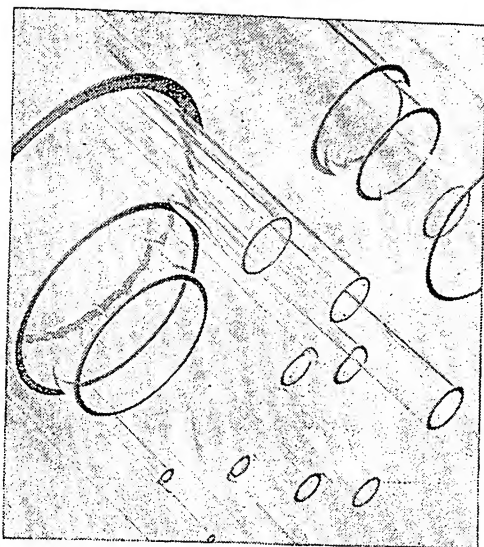
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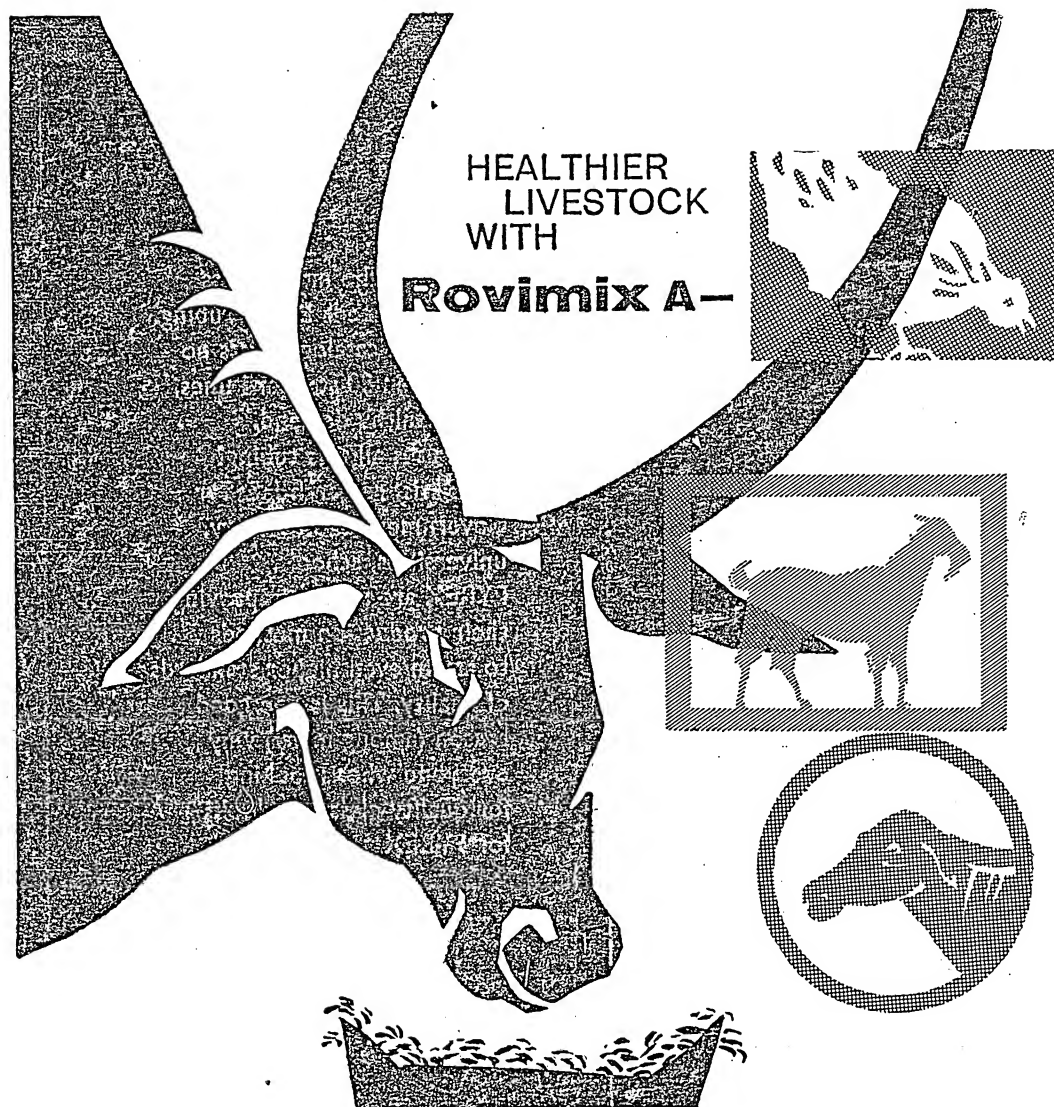
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This is a publication specially brought out on the occasion of the F.A.O. Regional Seminar on Food Technology for Asia and the Far East held in Mysore from August 1-8, 1959. It is a collection of 26 review articles, which cover exhaustively the research work done in India on some of the important aspects of Food Science and Technology, particularly those dealing with rice and rice substitutes; fruit and vegetable products; dehydration of foods; storage, packaging and transport of perishables; infant, invalid and protein-rich foods; beverages, spices and condiments; etc. The book represents under one cover the important lines of work and progress made in India in the field of Food Technology.

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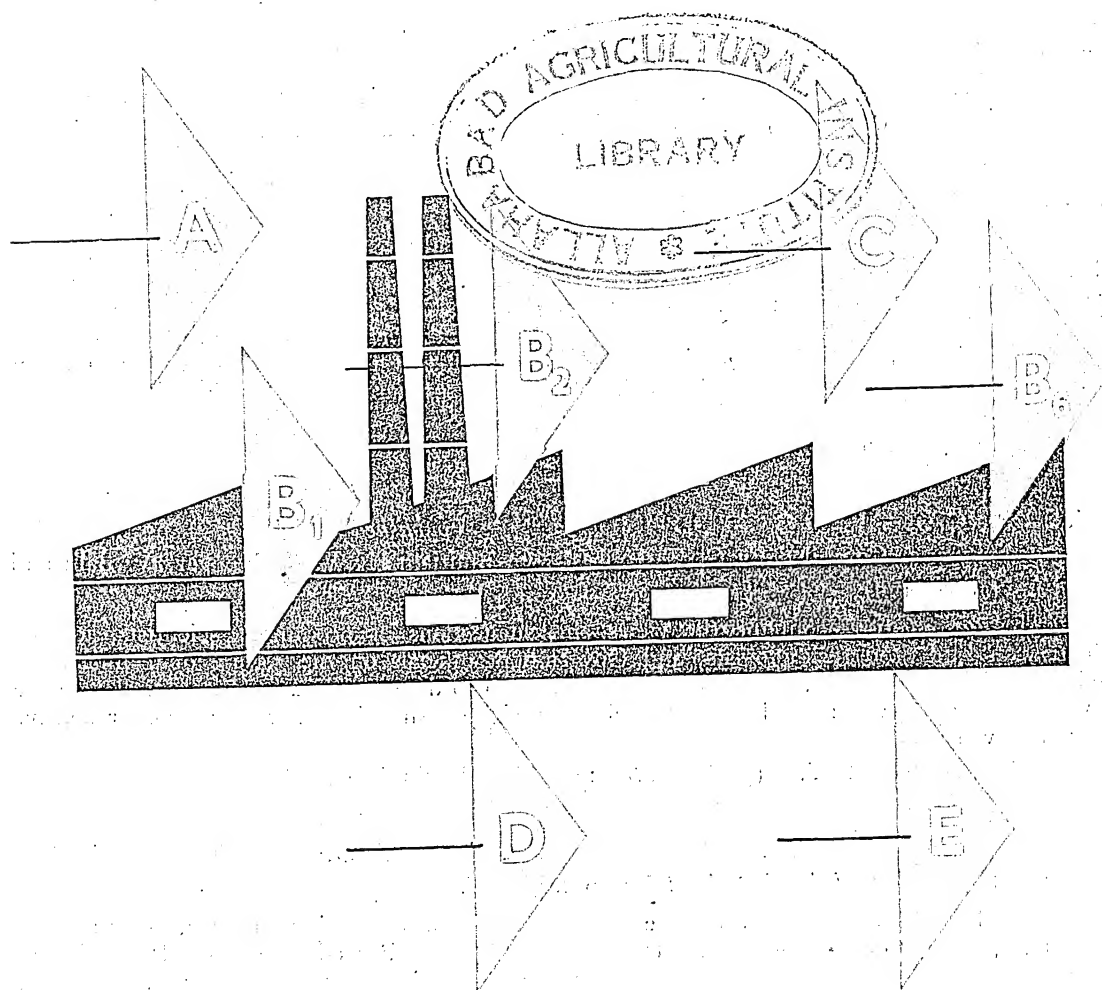
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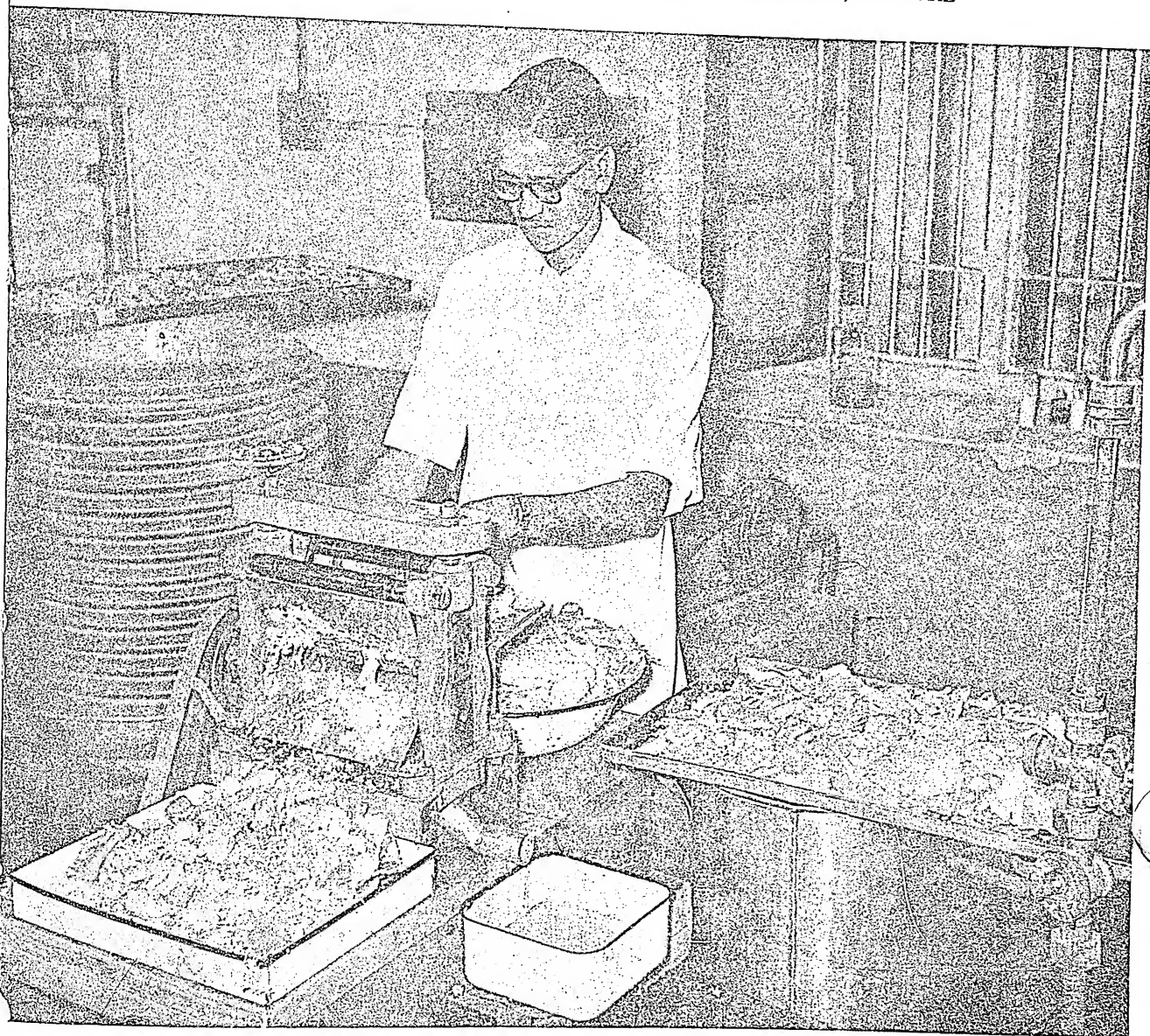
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NUTRITIVE VALUE AND UTILIZATION OF PASSION FRUIT WASTE (SKIN OR RIND)
(*Passiflora edulis* Sims.)

By J. S. PRUTHI

(Central Food Technological Research Institute, Mysore)

Passion fruit skin or rind (*Passiflora edulis* Sims.), which on an average, constitutes about 50 per cent of the whole fruit and is considered as 'factory waste' has been found to be a fairly rich source of carbohydrates, ascorbic acid (78-166 mg/100 g.), protein (12-15 per cent on dry weight basis) and pectin (9-15 per cent D.W.B.). The pectin recovered from passion fruit skin is of good quality having 175-200 jelly grade and as such forms an important bye-product. Besides, passion fruit skin has good manurial value. Animal feeding experiments revealed that the replacement of rice in poor South Indian rice diet upto 20 per cent level with passion fruit skin flour did not produce any adverse effect on the growth rate and general health of albino rats.

During the studies on the nutritive value and utilization of passion fruit (*Passiflora edulis* Sims.)¹⁻⁶, it was noticed that out of the three fruit components namely, juice, skin and residue, skin alone comprised about 45-50 per cent of the whole fruit and thus constituted a huge waste. Very little published information appears to be available on its chemical composition and commercial utilization. The available references⁷⁻⁸ cover only moisture, protein, crude fiber and ash analysis. In this paper, data pertaining to the detailed chemical composition and growth promoting value of passion fruit skin are presented and discussed.

Experimental

Raw material: Fresh purple skins of passion fruit were obtained, minced and immediately employed for analysis. Immediate analysis of aliquots thereof were conducted for moisture, ascorbic acid, acidity, sugars and pectin. The other constituents were determined during the course of 3-4 days, during which period, the minced skin was kept in small, brown, capped and waxed bottles in a freezer at 20°F till required for analysis. All items of analysis were conducted in duplicate.

Analytical methods: Moisture, ether extract, crude fiber, pectin, protein, starch, tannins, ash, etc., were determined by employing standard A.O.A.C. methods⁹. Ascorbic acid was estimated by the colorimetric method of Robinson and Stotz¹⁰.

Animal feeding experiments: The nutritive value of passion fruit skin was determined by the rat-growth method. The fresh skin was minced, dried in an electric drier at 55-60°C, powdered in a flour mill, sieved through a 60 mesh sieve (which removed about 3 per cent of the crude fibre) and fed to albino rats by replacing rice at different levels in the poor South Indian rice diet. Diet I comprised the poor South Indian rice diet (control), while diets II, III, IV and V were prepared by replacing the rice in the rice diet by the passion fruit skin flour at 10, 20, 50 and 100 per cent respectively.

Thirty freshly weaned young albino rats (about 4 weeks old and weighing 40-55 g.) were

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divided according to sex, litter and weaning weights into 5 groups (each comprising 3 males and 3 females) in a randomised block design. The rats were fed with the respective diets in individual cages for a period of 8 weeks. Records were maintained on the daily food intake, weekly gain in weight and any abnormalities in the experimental animals.

Results and Discussion

Chemical composition: Results of analyses on chemical composition of passion fruit skin conducted during 1952-54 are summarized in Table 1. Passion fruit skin which was hitherto considered as waste, is a fairly rich source of pectin (1.54-2.47 per cent), protein (2.04-2.84 per cent), mineral matter and ascorbic acid (78.3-166.2 mg/100 g.). Good quality pectin (methoxyl content, 9-10 per cent, anhydrouronic acid, 85-91 per cent and jelly grade, 175-200) can be recovered from the skin.

TABLE 1. *Chemical composition of passion fruit peel*
(On fresh weight basis)

Items of analysis	Range of variation		
	Maximum %	Minimum %	Average* %
Moisture ...	85.24	78.43	81.92
Ether extract ...	0.16	0.05	0.12
Crude fibre ...	7.13	4.57	5.01
Pectin (as calcium pectate) ...	2.47	1.54	1.78
Protein (N × 6.25) ...	2.84	2.04	2.56
Crude starch ...	1.36	0.75	0.87
Astringency (i) Tannins ...	2.47	1.78	1.99
(ii) Non-tannins ...	1.00	0.69	0.82
Total ash ...	1.94	1.32	1.47
Silica (SiO ₂) ...	0.04	0.01	0.02
Iron (Fe) ...	0.03	0.01	0.02
Calcium (Ca) ...	0.07	0.03	0.05
Phosphorus (P) ...	0.06	0.03	0.04
Potash (K ₂ O) ...	0.95	0.73	0.86
Ascorbic acid, mg/100 g ...	166.20	78.30	100.97
Carotene ...	...	...	traces

* Based on 12 analyses conducted during 1952-54.

Ascorbic acid content of skins of fruits at different stages of maturity is given in Table 2. The high values obtained by the direct titration method might be due to interference by tannins and other reducing substances present in the

skin. Ascorbic acid decreased with progressive ripening of the skin. Considerable variation was observed in the ascorbic acid content (ranging from 78.7 to 154.9 mg/100 g.). It is evident that the skins are a rich source of ascorbic acid.

TABLE 2. *True and apparent ascorbic acid content of passion fruit skins at different stages of maturity*

Stages of maturity	Dye titration method Asc. acid mg./100 g.	Colorimetric method		
		Total asc. acid mg/100 g.	True asc. acid mg/100 g.	True asc. acid as % of total
I. Green ...	163.1	131.8	111.6	85.3
II. Partially purple	154.2	117.4	102.0	85.4
III. Purple ...	*	101.2	88.6	87.6

* Because of the deep purple colour of the metaphosphoric acid extract of ripe purple skins, sharp end point could not be obtained.

Manurial value: Mineral analysis (Table 1) of fruit skin indicates that it would be of considerable value as a manure. One ton of dried passion fruit skin is equivalent in plant nutrient content to about 1 cwt. of ammonium sulphate, plus 1½ tons of sulphate of potash, plus about 10 lb. of double super phosphate. The fairly high fibre content and the astringent matter in the skin were considered as possible drawbacks in its successful utilization even as cattle feed. With a view to obtaining a better picture on this aspect, systematic animal feeding trials were conducted, the main results of which are presented below.

Nutritive value: Studies on rat-feeding trials revealed that in group No. V, where rice was completely replaced by passion fruit skin flour, the animals took very little food, probably because of its high astringency (due to tannins, etc.) and puckery taste. The rats started losing weight and two animals died by the end of second week and the remaining after 3-4 weeks, showing thereby that passion fruit skin flour as such was not acceptable to animals. However, in the other 3 groups and particularly in groups II and III, the rats ate well, put on weights (Table 3) and were active and healthy.

TABLE 3. *Effect of replacing rice in poor South Indian rice diet by passion fruit skin flour at different levels on the growth of albino rats*

Diet No.	Diets		No. & sex of rats	Av. initial body wt. g./rat	Av. daily food intake g./rat	Average weekly gain in body-weight g./rat	Blood analysis		
	Rice %	P.F. flour %					R.B.C. million/cu.mm	Haemo-globin (g/100ml)	
I	...	78.50	0.0	3M+3F	45.2	7.6	4.44	9.29	15.08
II	...	70.65	7.85	3M+3F	45.2	10.5	4.79	8.71	14.17
III	...	62.80	15.70	3M+3F	46.2	11.1	4.94	8.80	13.49
IV	...	39.25	39.25	3M+3F	44.8	11.0	3.42	8.80	13.34

* Standard error of the mean derived from the analysis of variance. Results for group V are not presented as all the rats died during the experiment.

The food intake in all the 3 groups (Diets II, III and IV) was much higher than that in the control rice diet (Table 3), and growth rates in Diets II and III were also slightly higher than that in the control group, but the difference between the three groups I, II and III was not significant. Diet IV (containing 50 per cent passion fruit skin flour), as judged from growth rate, was however found to be significantly inferior ($P < 0.01$) to any of the above three diets.

The blood analysis of the experimental animals did not reveal much differences, the R.B.C. and haemoglobin in the experimental animals being only slightly lower than the corresponding figures in the control groups (Table 3).

The animals were fed on the same diet for another 8 weeks, after which all the animals were dissected and examined for any internal disorders. No abnormalities were noticed except that the growth of rats in group IV (50 per cent passion fruit skin flour) was rather stunted.

In conclusion, passion fruit skin flour, as prepared above, could replace rice in the South Indian rice diet upto 20 per cent level. Feeding at higher level (50 per cent) did not prove much useful in promoting growth.

While these studies were completed in 1955, an interesting report appeared in literature stating that feeding tests with dairy cows indicated

satisfactory milk production with 25 per cent passion fruit rind in their ration^{8,12}.

Acknowledgment

The author warmly thanks Dr Girdhari Lal, Assistant Director and Dr V. Subrahmanyam, Director, Central Food Technological Research Institute, Mysore, for the keen interest in this investigation. Grateful acknowledgment is also made to Dr M. Swaminathan and his staff for the facilities provided for conducting the animal feeding experiments and to Sri A. N. Sankaran for statistical analysis of some data.

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NON-ENZYMATIC BROWNING IN FOODS: FURTHER] STUDIES IN SOME FRUIT JUICES AND VEGETABLE PULPS

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Results of an investigation on the non-enzymatic browning of some fruit juices and vegetable pulps showed that (i) pea puree was more susceptible to ring discolouration which could be controlled by the addition of ascorbic acid. There was, however, no such discolouration in the case of field bean puree. (ii) In the case of *amla* juice containing 300 mg. per cent of natural ascorbic acid, browning was not enhanced by further fortification with 250 mg. per cent of ascorbic acid. (iii) In *amla* extracts, tyrosine did not accelerate browning while glycine caused more browning than lysine. Cysteine did not show any protective effect and (iv) added ascorbic acid caused more browning in lime juice than in orange or tomato juices.

Non-enzymatic browning in passion fruit, lime, orange and jaman juices and jack fruit, mango, papaya and tomato pulps packed under different treatments, has been described in an earlier publication¹. This paper presents the work which was extended to products like *amla* (*Phyllanthus emblica*) extract which is rich in ascorbic acid and tannins and to vegetable purees from peas and field beans (*Dolichos lab lab*).

Materials and Methods

Lime and orange juices, tomato juice and serum and papaya and mango pulps were prepared and packed as described earlier¹. In addition, ascorbic acid was added at 500 mg. per cent level to study the effect of this fortification. The edible portion of *amla* was mixed with half the amount of water, disintegrated in a waring blender and pressed in a hydraulic press. Shelled peas and field bean seeds were mixed with an equal weight of water, cooked at 10 lb. pressure for 30 and 60 minutes respectively, passed through a pulper and pressed through a 30-mesh sieve to obtain the puree. The juices and purees were packed in pyrex glass test tubes under the following treatments:

- (i) Preserved with 350 ppm SO₂ (added as potassium metabisulphite).
- (ii) Preserved by adding 1,000 ppm sodium benzoate.
- (iii) Processing at 175°F. for 30 minutes in the case of *amla* and at 10 lb. pressure for 45 minutes and at 12 lb. for 60 minutes, in the case of pea and field bean purees, respectively.

- (iv) Hot deaeration was done by boiling at 115-120°F, under a vacuum of 27 inches, for 3-5 minutes before sealing the test tubes. *Amla* extract and the vegetable purees were fortified with 250 and 500 mg. per cent ascorbic acid respectively.

Glycine, lysine, cysteine and tyrosine were added to give 0.1M concentration in the *amla* extract. Cysteine and tyrosine were dissolved in the minimum amount of dilute hydrochloric acid before adding to the *amla* extract.

The sealed pyrex test tubes were stored at 37°C, except the control which was stored at 0°F.

In the case of fruit juices and pulps, 4 ml. of the filtered sample was mixed with 6 ml. ethanol and the intensity of colour of the filtrate was measured as optical density using a Lumetron colorimeter employing the 42-blue filter. The clear liquid obtained after centrifuging was taken in the case of vegetable purees. The ultraviolet absorption spectra of the filtered diluted solutions was taken using a Beckman Quartz Spectrophotometer in the range 250-400 mμ. The pH values were taken with a Beckman pH meter. Ascorbic acid was estimated by the xylene extraction method of Robinson and Stotz².

Results and Discussion

Amla: A peak at 275 mμ was observed in the beginning with *amla* extract due to the presence of tannins. Although there were some variations (Table 1), the general trend of the values did not suggest any striking difference, considering the limitations due to the high dilutions (1:1000)

TABLE 1. Optical densities at 275 m μ of samples of Amla extract packed under different treatments and stored at 37°C

Period of storage (weeks)	350 ppm Sulphur dioxide	1000 ppm Sodium benzoate	Pasteurized	Hot deaerated and pasteurized	Hot deaerated & vacuum packed	250 mg.% Ascorbic acid	Glycine (0.1 M)	Lysine (0.1 M)	Cysteine (0.1 M)	Tyrosine (0.1 M)
0	703	725	750	761	753	765	755	712	709	750
8	713	730	753	756	763	769	758	720	713	746
26	714	732	755	754	774	774	769	731	724	762
52	715	740	748	750	783	789	759	742	770	768

TABLE 2. Visible browning (Optical densities) at 420 m μ of samples of Amla extract packed under different treatments and stored at 37°C

Period of storage (weeks)	350 ppm Sulphur dioxide	1000 ppm Sodium benzoate	Pasteurized	Hot deaerated and pasteurized	Hot deaerated & vacuum packed	250 mg.% Ascorbic acid	Glycine (0.1 M)	Lysine (0.1 M)	Cysteine (0.1 M)	Tyrosine (0.1 M)
0	0.20 (532)	0.22 (526)	0.44	0.44	0.49	0.45	0.45	0.46	0.44	0.45
26	2.50	2.56	1.82	2.01	1.82	2.02	2.42	2.35	1.60	2.07
40	3.90	3.14	2.64	2.62	2.33	2.48	3.51	3.12	2.21	2.12
52	4.50 (84)	4.00 (104)	3.10 (92)	3.00 (95)	2.90 (96)	3.30 (192)	4.53 (82)	3.74 (88)	2.83 (116)	2.32 (105)

Values in brackets indicate the ascorbic acid content in mg./100ml.

employed. Precursors of browning compounds such as furfural or its derivatives³ were probably not formed in sufficient concentration during storage to cause significant absorption. The visible colour of the samples, however, increased progressively during storage (Table 2). Sulphited samples showed slightly more browning compared to those preserved with benzoate or pasteurisation, contrary to expectation. Among the amino acids used, glycine contributed more towards browning than even lysine which is known to play an important role on account of its terminal amino group⁴. Cysteine although known to retard browning, did not show any protective influence. The colour of the sample turned yellow instead of brown. Unlike in tomato serum⁵ and organic acid-amino acid model systems⁶ tyrosine showed the least browning. Further, fortification with 250 mg. per cent of ascorbic acid in the case of amla extract which initially contained 300 mg. per cent ascorbic acid,

did not result in any marked increase in browning thereby confirming the earlier findings⁴ that there was not much difference in the degree of browning caused with 250 and 500 mg per cent of ascorbic acid. The pH values of these amla extracts packed under various treatments varied from 2.8 to 3.1 during storage.

Other juices and pulps: Addition of 500 mg. per cent ascorbic acid increased browning considerably (Table 3) in case of orange, and tomato juice, tomato serum, mango pulp and papaya pulp while the effect of other treatments was similar to that already reported¹. Browning was more in lime juice samples than in others. There was, however, no appreciable loss in the ascorbic acid content of the fortified samples at the end of 60 weeks storage (80-100 mg. per cent) indicating thereby that the other components of lime juice may be involved in this enhanced discolouration. In papaya and mango pulps, browning was considerably less than in the juice

TABLE 3. Optical densities at 420 m μ of some fruit juices and pulps preserved by different methods and stored at 37°C.

Storage period in weeks		Sulphur dioxide	Sodium benzoate	Pasteurisation	Hot deaerated, vacuum packed and pasteurised	500 mg. per cent ascorbic acid and pasteurisation
Lime juice	0	0.35	0.39	0.40	0.40	0.41
	17	0.51	0.57	0.49	0.55	1.10
	60	0.80	0.85	0.72	0.70	2.10
Orange juice	0	0.15	0.20	0.22	0.22	0.25
	17	0.30	0.70	0.62	0.45	0.80
	60	0.38	0.85	0.81	0.67	1.15
Tomato juice	0	0.15	0.18	0.20	0.20	0.21
	17	0.29	0.31	0.31	0.24	0.44
	60	0.60	0.65	0.60	0.45	1.05
Tomato serum	0	0.27	0.37	0.40	0.40	0.41
	17	0.40	0.52	0.50	0.47	0.60
	60	0.55	0.90	0.72	0.65	1.15
Papaya pulp	0	0.05	0.08	0.09	0.09	0.10
	17	0.08	0.24	0.14	0.18	0.36
	60	0.11	0.50	0.35	0.38	0.90
Mango (Badami) pulp	0	0.23	0.24	0.24	0.24	0.24
	60	0.44	0.51	0.50	0.50	0.62

TABLE 4. Optical densities at 420 m μ of pea and field bean purees preserved by different methods and stored at 37°C

	Heat processed only	Sulphur dioxide added	Sodium benzoate added	Vacuum packed	Ascorbic acid added
Pea puree					
0	0.26	0.21	0.29	0.27	0.29
52 Weeks	0.50	0.32	0.50	0.45	0.83
Field bean puree					
0	0.18	0.16	0.19	0.18	0.21
52 Weeks	0.35	0.21	0.42	0.35	0.60

samples due probably to the protective influence of β -carotene in them⁵.

Data for the ultraviolet absorption (not given here) of the stored samples did not lead to any additional conclusions. The pH values of the stored lime juice samples (2.4-2.6) were less

than those for the other juices (3.3-3.6). There was no significant change in pH during storage in any of the samples.

Pea and field bean puree: The pulps of these materials which were subjected to the usual high processing temperatures in addition to the initial heat treatment to facilitate the preparation of the puree were brown as a result of partial conversion of chlorophyll to pheophytin. Westcott *et al.*⁷ indicated that acetone extracted green bean puree became dark on heat processing and this was partly attributed to the occurrence of a polyphenol type of reaction. Changes in visible browning (Table 4) in these products showed that ring discolouration, which was noticeable in samples containing sodium benzoate, was controlled effectively by ascorbic acid and to a lesser degree by sulphur dioxide. Hot deaeration followed by vacuum packing was also slightly helpful. The extent of general browning was assessed after discarding the upper dark layer due to oxidative discolouration. The general non-enzymatic browning was less in sulphited samples than in others. On the other hand, fortification with ascorbic acid caused more browning. There was no significant change in the pH of samples during storage (4.9-5.1). There was no discolouration in field bean puree with any of the treatments.

Acknowledgment

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NUTRITIVE VALUE OF BALANCED MALT FOODS

Many countries in Asia, Africa and Latin America are not able to produce sufficient quantities of protective and protein-rich foods such as milk, eggs and fish¹. The diets consumed by weaned infants, young children and other vulnerable sections of the population consist predominantly of cereals, roots and tubers and hence are deficient in proteins, certain vitamins and minerals. Deficiency diseases are, therefore, widely prevalent among weaned infants and young children².

During recent years, vegetable proteins have been utilised for supplementing the diets of weaned infants and young children³. Several workers⁴ have successfully used milk from soya bean and groundnut for feeding infants. Chick and Slack⁵ and Dean⁶ have shown that a highly nutritious food can be prepared by blending barley malt extract with soya flour, which could be used to replace about half the milk in the diet of infants up to one year of age and even more in the diet of older children. A process for the preparation of balanced malt food based on a blend of cereal malt, groundnut flour and skim milk powder was developed by Chandrasekhara *et al.*⁷. Experiments on albino rats showed that the malt foods possessed high nutritive value. Subrahmanyam *et al.*⁸ also found that supplementation of the diet of children with two ounces of malt food produced a marked improvement in their growth and nutritional status. Skim milk powder being scarce, the nutritive value of malt foods based on blends of vegetable proteins such as pulses, groundnut flour and sesame flour as compared with blends containing skim milk powder has been studied.

The present communication deals with studies on the overall nutritive value of four blends of malt foods using albino rats.

Ragi malt used in this investigation was prepared according to the general method described earlier⁷. Four blends of malt foods were prepared (Table 1). The amounts of *ragi* malt and groundnut flour were kept at the same level in all the blends. Two of the blends (A and B) contained defatted soya flour, while the other two (C and D) contained Bengal gram flour in place of soya flour. Malt foods I and III contained

TABLE 1. *Percentage composition of malt foods* and milk food*
(Values per 100 g)

	Malt foods				Milk food
	(A)	(B)	(C)	(D)	
Ragi malt ...	22	22	22	22	...
Groundnut flour ...	25	25	25	25	...
Soyabean flour ...	30	30	...	...	...
Bengal gram flour ...	...	...	30	30	...
Sesame flour ...	20	...	20	...	...
Skim milk powder ...	...	20	...	20	70.0
Vanaspati ...	3	3	3	3	9.0
Starch ...	...	...	...	...	18.0

* The calcium, phosphorus and vitamins A, C, D, thiamine and riboflavin were adjusted to nearly the same level by fortification.

sesame flour (at 20 per cent level) while in foods II and IV, sesame flour was replaced by an equal amount of skim milk powder. For comparing the nutritive value of malt foods, a milk food having a similar composition was prepared. All the foods were adequately fortified with vitamins and minerals. The chemical composition of the malt foods and the milk food determined according to A.O.A.C. methods⁹ is given in Table 2. For the purpose of the feeding trials, the malt foods were mixed with starch and sugar in equal proportions so that the protein content of the different diets was approximately 20 per cent. Composition of the experimental diets is given in Table 3.

TABLE 2. *Chemical composition of malt foods and milk food*
(Values per 100g)

	Malt foods				Milk food
	(A)	(B)	(C)	(D)	
Protein (N×6.25) (g)	36.9	37.9	28.7	29.60	25.2
Fat (g) ...	10.2	7.7	9.6	7.2	9.0
Carbohydrate (g) ...	36.1	39.5	45.3	47.9	54.4
Calcium (g) ...	1.41	1.38	1.44	1.42	1.44
Phosphorus (g) ...	1.15	1.10	1.14	1.17	1.2
Iron (mg) ...	8.3	7.9	8.0	8.2	8.0
Vitamin A (I.U.) ...	3000	3000	3090	3000	3000
Thiamine (mg) ...	0.9	0.95	0.96	0.93	0.92
Riboflavin (mg) ...	1.32	1.35	1.34	1.31	1.32
Vitamin C (mg) ...	30	30	30	30	30
Vitamin D (I.U.) ...	300	300	300	300	300
Calories ...	384	379	382	375	399

TABLE 3. *The composition of experimental diets**

		Diets				
		I	II	III	IV	V
Malt food (A)	...	54	...	...	...	...
Malt food (B)	...	...	53	...	...	...
Malt food (C)	...	...	...	70	...	...
Malt food (D)	...	...	...	...	67	...
Milk food	...	...	...	...	...	79
Corn starch	...	26	27	10	13	11
Cane sugar	...	20	20	20	20	10

* The protein content of the diets was about 20%.

The nutritive value of these blends was determined by the rat growth method. Five groups of albino rats (28 days old) distributed equally with regard to sex, litter mates and body weight were fed on the different diets. The malt foods or the milk food served as the sole source of all dietary essentials in the diet. Careful records of daily food intake and weekly gains in weight of the animals were maintained. The results are shown in Table 4.

TABLE 4. *Average weekly increase in body weight of rats fed on diets containing malt foods and milk food*
(Duration of experiment—8 weeks. No. of animals in each group—4 males and 6 females)

Diet	Average initial weight (g.)	Average daily food intake (dry wt) (g.)	Average weekly gain in weight (g.)
Malt food (A)	...	45.4	9.9
Malt food (B)	...	45.5	10.3
Malt food (C)	...	45.2	9.8
Malt food (D)	...	45.2	10.3
Milk food	...	45.2	9.8

Least significant difference ($P=0.05$) 1.36 g.

Statistical analysis of the data showed no significant difference in the growth promoting value of the foods. Substitution of soyabean flour by Bengal gram flour or the substitution of skim milk powder by sesame cake did not affect the overall nutritive value of the foods as judged by the growth of rats. Soyabean flour being not abundantly available in the country, it can be substituted by Bengal gram flour. Malt foods containing sesame flour give the same growth rates as those containing skim milk powder; still, the foods containing milk powder are more acceptable than those containing sesame flour to the consumers.

Further investigations on the P.E.R. of the proteins of the malt foods and on the composition of the liver and blood of rats fed on the different malt foods is in progress.

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NATURE OF TARTARIC ACID IN TAMARIND

Of the four isomers, viz., *d*-, *l*-, racemic and mesotartaric acids, only *d*-tartaric acid occurs naturally in many fruits and leaves. Only one case of occurrence of *l*-tartaric acid in fruits and leaves of *Bauhinia reticulata* has been reported¹. So far, the meso-isomer has never been identified in any plant tissue, although fungi appear to possess enzymes capable of converting epoxysuccinate to meso-tartrate².

Stafford^{3,4} found enzymes in cell-free plant preparations which can oxidize meso-tartrate to dihydroxy fumarate. The identification of this isomer in higher plants would thus be of great interest. In a study of the distribution of tartaric acid in the leaves of certain Angiosperms, Stafford⁵ found relatively large amounts of an unidentified acid in the meso-tartrate area of chromatograms. Positive identification of the isomer was not possible for want of a specific test. She, however, feels that the meso-form could have been overlooked in plants because it has solubility characteristics which differ from those of the other tartrates.

At the instance of Dr. Stafford (private communication), we have examined the nature of tartaric acid present in the leaves and fruits of tamarind (*Tamarindus indica*, Linn), both of which contain large amounts of tartaric acid^{6,7}. Sodium metavanadate gives an orange-red colour with the optically active tartrates, but not with meso-tartrate⁵. Both the leaves and berries of tamarind showed a strong metavanadate test throughout the year, starting from fresh foliage in April-May to January-February when the fruits are ready for harvest. Paper chromatography of extracts of the leaves and berries using different solvent systems always showed

only two compact acid spots for *l*-malic acid and *d*-tartaric acid as identified by R_f values, and only one orange spot on spraying with sodium metavanadate solution. Specific rotation of purified tartaric acid isolated (5 per cent solution) was $[\alpha]_D^{24} = +14.0^\circ$.

Allowing for about one per cent malic acid present, the total acidity of tamarind leaf juice or berry extracts could always be quantitatively accounted for by tartaric acid, estimated by separation as cream of tartar or colorimetrically by metavanadate method⁸. Both the methods are inapplicable to the meso-tartrate.

It is thus clear that the tartaric acid present in tamarind at all stages is only the optically active *d*-form.

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Technical Seminars

THE Seminar which is a regular scientific activity of the CFTRI provides an open forum for all scientific workers of the Institute in so far as one of them presents a paper on a problem on which he is engaged or reviews an aspect of Food Science and Technology, while others participate in the discussion and express their views on the subject matter of the paper. The visits of distinguished scientists and technologists are also availed of for arranging addresses to such gatherings. Summaries of the Seminars held during October-November 1960 are given in this section.

S (IS) 26

A study of the pesticide residues on foodstuffs, by K. Krishnamurthy (October 27, 1960).—Pesticides are chemicals that are used in the control of various types of pest organisms. Pest control in the broadest sense, is a continuous warfare against man's competitors, carried out on countless fronts with operations ranging in scope from those of a housewife and home gardener to the global efforts of F.A.O. and W.H.O. Insecticides belong to the class of pesticides.

Nearly 4-5 million tons of grains amounting to about 5 per cent of our production and equivalent to our imports are lost every year due to spoilage by insects, moisture and rodents. Insect spoilage occurs both in the field and in storehouses. In a country like India, vigorous hygienic measures alone cannot fully cope with insect infestation in stored produce and the use of insecticides becomes a necessary complement. Consequently, the use of insecticides both during pre-harvest and post-harvest periods, is on the increase in our country.

Study of the potential hazards to persons not directly associated with pesticides is very important as it is a problem concerning the health of the entire population of human beings and livestock. The insecticides in general use are either the chlorinated hydrocarbons or the phosphatic insecticides. The phosphatic insecticides are not considered as residual insecticides, while chlorinated hydrocarbons persist on the surfaces and so constitute the residue problem. The residues of insecticides in foodstuffs occur due to variety of reasons.

In order to assess the extent of insecticide contamination in our foodstuffs, about 100 samples of grain and ten samples of potatoes available in the market and suspected to be contaminated with insecticide were analysed. DDT and BHC were present in nearly 80 per cent of the samples and over 50 per cent of the samples contained more than the permissible limits.

Preliminary studies were carried out to assess the role of nutritional status of experimental animals (weanling albino rats) on the toxicity of insecticides, as manifested on the growth, condition of vital organs and general health. The insecticides used in the study were dieldrin at 0, 5 and 25 p.p.m. levels and lindane at 0, 10, 100 and 250 p.p.m. levels. The insecticides were incorporated (1) in a diet adequate with respect to protein, fat vitamins and minerals and (2) in a poor rice diet recommended by Vanaspati Research Advisory Committee.

The results of feeding trials for 16 weeks revealed the following points: (1) the insecticide when fed along with poor rice diet affected the growth rate of rats adversely while the same along with an adequate diet had no effect on the growth rate; (2) there was an increase in the percentage liver weights, amount of insecticide stored and the storage ratio in the body fat and the liver in the case of rats fed the insecticide along with poor rice diet as compared to rats fed adequate diet; and (3) there was no gross histological changes in any group of rats. Slight infiltration of fat and centralabular enlargement of cells were, however, observed in the case of rats fed dieldrin at 25 p.p.m. and lindane at 250 p.p.m.

levels along with poor rice diet, while no change was noticed in the case of rats fed adequate diet.

The speaker then described the results of studies carried out on the detection, estimation and oral toxicity and metabolism of citicide, a polychloro derivative of turpentine. A colorimetric method based on the colour reaction of citicide with pyridine and aqueous potassium hydroxide, has been developed for its detection and estimation.

Studies were carried out to evaluate the potential consumer's hazards of citicide by acute oral toxicity and metabolism studies, on adult male albino rats. The results of single dose oral toxicity studies on citicide revealed that dosages up to 6g/kg body weight did not produce immediate mortality. All the maximum dosage tried only 4 rats out of 60 experimental animals died within a period of one week. Studies on the metabolism of citicide indicated that citicide was dehalogenated by the rats as reflected by the excretion of chloride in large amounts in the urine of treated animals. The rest of the molecule is perhaps converted into a phenolic substance which in turn is excreted more as ethereal sulphate and to a less extent as glucuronic acid conjugates. The treated animals showed more of organic chloride in their body fat than the control animals, indicating the storage of relatively less or non-toxic degradation products in the body fat. Rats which died during the course of the experiment did not consume the diet and excreted citicide in faeces, and chloride and glucuronic acids in urine in comparatively smaller amounts which indicated the possibility of impaired detoxication mechanism which

might have been one of the causes of relatively rapid mortality.

The microscopic changes were less pronounced in the kidney than in the liver in all the animals examined. Slight basal vacuolisation in kidney and liver, cellular enlargement, focal necrosis and the presence of acidophilic bodies were noted in some of the treated animals. The results of the present study on the single dose oral toxicity have revealed that citicide is detoxified in the rat system to a large extent and the acute oral toxicity of the chemical is much lower than that of many of the chlorinated hydrocarbon insecticides.

The points raised during the discussion related to method of assessing chronic toxicity, distribution of citicide in different tissues, whether the food intake remains the same with high dose of gammaxene, whether death of rats was due to loss of chloride and if so whether administration of NaCl would serve as antidote, nature of histopathological changes in the cells, method of estimation of glucuronic acid, low protein diet being more resistant to the insecticide as compared to high protein diet particularly with CCl₄, effects of inhaling insecticides, whether conjugated citicide also gives the colour reaction in the method of estimation, effect of dieldrin on the nervous system, etc.

Winding up the discussion the President commended the paper as an interesting one with many possibilities. Chlorine was the first toxic substance used and as it is available in surplus, more of chlorinated compounds should be produced. The toxicity of pesticides on mammals should be thoroughly investigated. The ultimate aim should be to find out an absolutely safe product which may cause desiccation of insects thereby destroying them. In this connection, he said that work on pyrethrum should be continued. It was necessary to use the insecticides with discretion.

S(IS) 27

Nutritive value of Paushtik-atta, by M. Narayana Rao, R. K. Bhagwan, P. P. Kurien and V. B. Oberoi (November 7, 1960).—Speaking first, Dr. M. Narayana Rao stressed the importance of cereals in human dietary, particularly in under-developed countries where protein-rich and protective foods are not available in sufficient quantities. India is at present importing enormous quantities of wheat and rice to make up the deficit of cereals. It has become imperative to find out alternate sources of foodstuffs to meet this deficit. Roots and tubers which are very heavy yielders as compared to cereal crops can with advantage be used for the purpose. Tapioca, for example, can be grown in areas where fair amounts of sub soil water is present, the normal yield being 3-4 tons per acre. Earlier work has shown that tapioca flour can with benefit be admixed with cereals and that addition of protein-rich food like low fat groundnut flour further enhances the nutritive value.

With this background, the work on the standardization and subsequent nutritive value of *paushtik atta* was undertaken. *Paushtik atta* consists of a blend of whole wheat flour (75 parts), tapioca flour (17 parts) and low fat groundnut flour (8 parts). It contains a slightly higher amount of protein (13.4 per cent) as compared to whole wheat flour (12.2 per cent). Animal experiments were carried out to study the over all nutritive value of diets based on whole wheat flour, *paushtik atta* and fortified *paushtik atta*. Fortified *paushtik atta* was prepared by fortifying *paushtik atta* with calcium carbonate (156 mg/100g) and riboflavin (0.1mg/100g). The results have shown that the diets based on *paushtik atta* promoted a significantly higher growth than that based on whole wheat flour. Fortification of *paushtik atta* resulted in a further but slight improvement in the growth of rats. It was

also found that the P. E. R. of the proteins of *paushtik atta* was significantly higher than that of whole wheat flour. This may be due to the additional lysine provided by groundnut and tapioca flours. *Paushtik atta* is, therefore, as nutritious, if not better than whole wheat flour. Studies on organoleptic evaluation showed that the different preparations made out of *paushtik atta* were quite acceptable. More than 60 per cent of the tasters preferred the samples made from *paushtik atta* to those made from whole wheat flour. These investigations have shown the possibilities of blending wheat flour to the extent of 25 per cent with a blend of groundnut flour and tapioca flour which are available in the country in plenty and thus augment the supplies of wheat in the country by 25 per cent. Dr. Narayana Rao said that large scale production of *paushtik atta* should be undertaken by the State Governments with the help of the local oil mills and flour mills. This project should be undertaken in the national interest to save a large amount of foreign exchange.

Dr R. K. Bhagwan then discussed the effect of replacing wheat in a poor Indian diet by *paushtik atta*. Institution feeding experiments with 32 children aged 6-12 years carried out for a period of 3 months showed that there was considerable improvement in the height, weight, nutritional status and haemoglobin and R.B.C. count of the blood of children fed a diet consisting of *paushtik atta* as compared to the control group fed on wheat flour diet. The results were, however, not statistically significant.

Presenting the results of the metabolism studied carried out during the feeding studies on children, Mr P. P. Kurien said that on *paushtik atta* diet, the intakes of nitrogen and calcium were slightly higher and phosphorus slightly lower than those fed on whole wheat flour diet. The retention of nitrogen, calcium and phosphorus

by the children on the *paushtik atta* diets were slightly higher than those fed on whole wheat flour diets, though the difference was not statistically significant. The apparent digestibilities of the proteins of the two diets were of the same order (about 75 per cent).

Mr V. B. Oberoi then discussed the results of extension work carried out in U. P. which is predominantly a wheat consuming area in collaboration with the State Agriculture Department and the Planning Research and Action Institute, Lucknow. As tapioca is not grown at present in U.P., the cultivation of the tuber was first demonstrated. 20 tons of *paushtik atta* made at the C.F.T.R.I. were despatched to Lucknow. It was sold by the Civil Supplies Department of U.P. Government through fair price depots at a price slightly higher than that of the rationed whole wheat *atta* or wheat grain. Consumer acceptance data were collected by the Planning Research and Action Institute, Lucknow. The *paushtik atta* was compared with whole wheat *atta* in respect of kneading quality, taste, colour and crispness of the cooked articles like

roti, poori, paratha, etc. The results revealed that more than 50 per cent of the consumers interviewed, liked *paushtik atta* better than whole wheat flour. They were also willing to purchase *paushtik atta* regularly, if made available. The speaker concluded by saying that the ultimate success of the project depended on the successful cultivation of tapioca in U.P. on an extensive scale and emphasized the need for long range extension and follow up work in the State.

The points raised during the discussion related to: need for having a larger number of subjects for institution feeding trials, mode of administration of *paushtik atta*, account for large increase in haemoglobin of children in the experimental group, need for giving a proper nomenclature to the product, object of selecting only riboflavin for fortification, feasibility of using rice polishings rich in B-vitamins for fortification, variety of wheat used in making *paushtik atta*, keeping quality of *paushtik atta* as compared to wheat *atta*, possibility of increasing the amounts of groundnut and tapioca flours in

the blend to bring down its cost further, need for including another control group on fortified wheat flour etc.

Winding up the discussion, the President said that India was importing one third of her requirements of wheat and that the main object of this experiment was to show how the wheat supplies could be augmented by larger yielders such as roots and tubers, thus saving a lot of foreign exchange. *Paushtik atta* can be made easily and can also be fortified without adding much to the cost. The consumer acceptability trials carried out independently by Planning Research and Action Institute have clearly shown the favourable response towards the purchase of *paushtik atta*. He mentioned that feeding experiments for much longer periods might show statistically significant results. *Paushtik atta* can be kneaded even with cold water because it contains enough of gluten. He concluded by stressing the need for implementing projects like this in practice to save the country from facing more difficult problems.

Chewer's favourite

ASOKA SCENTED BETELNUT POWDER

Manufacturers: M. K. Krishna Chetty, Post Box No. 106, Coimbatore

Information and Advice

IN pursuance of the policy of rendering technical aid to food industries in the country, the CFTRI supplies information on technical and other problems, carries out analytical work and undertakes short- and long-term investigations on behalf of the industry, besides bringing out publications containing important technical advances in different aspects of Food Science and Technology. The Institute deals with a number of enquiries from various food industries and others interested in Indian processed food products. A few of the enquiries answered are reproduced in this section.

Terpeneless and sesquiterpeneless orange oil

E (IS) 91

I shall be thankful if you can kindly furnish necessary information on the preparation of terpeneless and sesquiterpeneless flavours from orange oil. (Calcutta).

For the preparation of terpeneless and sesquiterpeneless sweet orange oil, the oil first obtained from the peels is concentrated to about one-tenth of its volume by vacuum distillation. The concentrated oil is then taken in a still or retort fitted with an efficient fractionation column and slowly distilled under vacuum (pressure not exceeding 1 mm.). The distillate is collected in about 20 equal fractions, which are numbered and then tested for solubility in 80 per cent alcohol. Those fractions which show a solubility at 20°C of one part of oil in 9 volumes of alcohol, are bulked together and form sesquiterpeneless oil. The yield of this oil is about 2.0-2.5 per cent of the original oil. Its use in the preparation of fruit squashes prevents the formation of the objectionable ring found on the necks of bottles containing inferior product and gives the squash a fresher and purer flavour. The following limits have been suggested for a number of terpeneless orange oils:

Specific gravity at 15.5°C	...	0.8926 - 0.9094
Aldehyde content calculated as decyl aldehyde	...	29.50 - 36.65%
Free alcohol content	...	37.8 - 44.9%
Ester content	...	8.0 - 12.0%

The free alcohols are chiefly *d*-linalool and *d*-terpineol.

Bottling of apple juice

E (IS) 92

My factory wants to start bottling of apple juice but the main problem is that we are getting fruits containing 1.0-1.5 per cent acidity while 0.7-0.8 per cent is most desirable. If sodium bicarbonate is used to neutralise the acidity, it imparts a foreign taste. Please suggest the best method of obtaining a juice of optimum sugar-acid ratio. What is the best method of clarifying the juice? (Haldwani, Nainital District).

The apple juice depends for its popularity on a characteristic, delicate and refreshing flavour. Precautions should therefore be taken in the selection and proper blending of fruits. It is necessary that good quality apples be used if a juice of perfect sugar-acid blend and flavour is desired. The undermentioned varieties of apples grown in the Kumaon Hills have been found to be quite good for the extraction and preservation of apple juice:

Buckingham, Gano, Jonathan, King David, McIntosh, Northern Spy, Spitzenburg, Yellow Newton, Pippin, Stirmer, Golden Russet, American Russet, Winter Banana, Blenheim Orange Pippin, etc.

In case you are using some varieties high in acid, you can blend the high-acid varieties of apples with the sweet varieties like Delicious, Winter banana, early Sansberry, etc., to get a juice having acidity from 0.65 to 0.7 per cent expressed as malic acid. The brix of the juice should be adjusted to 12.5 per cent by addition of sugar if necessary.

The use of buffer salts such as sodium bicarbonate to reduce the

acidity in the apple juice is not desirable as they always leave an undesirable taste and also the juice extracted and preserved from unripe tart fruits will be lacking in flavour and aroma.

Clarification: The procedure consists in straining the juice to remove coarse particles, chilling the juice immediately to 30°-54°F by passing through tubes cooled by ice cold water, storing the juice overnight in tanks, draining of the settled juice and filtering it.

Pectic materials are the important colloidal substances present in apple juice. Coagulation of the pectins of apple juice immediately after the extraction is an essential step in making high-grade clear apple juice. The coagulation of pectinous materials can be effected by holding the juice at reduced temperatures (32°-54°F) and the time required for the clarification varies widely from 12 hours to as much as six weeks. The usual filtration procedure consists in first mixing water or some of the juice with filter aid to give a thin slurry which is pumped through the filter press. As the main body of the juice is being filtered, a small amount of filter aid is added continuously in order to prevent clogging of the filter with apple colloids. The resulting juice is brilliantly clear.

Use of pectic enzymes: Most of the bottled apple juice is clarified by commercial pectic enzymes such as Pectinol or Filtragol. The enzyme is supplied by the manufacturer as a mixture of dextrose and dry enzyme, the former acting as a carrier. It also contains a small amount of gelatine.

The required amount of enzyme preparation is added to the freshly expressed juice and mixed thoroughly. Usually the juice is kept at room temperature but activity is found most rapid at 100°F. The enzyme is allowed to act overnight. The juice is then drawn off, mixed with a filter aid such as infusorial earth and filtered in a filter press. The resultant juice is sparklingly clear.

It is advisable to determine by small-scale tests the optimum concentration of enzyme required for clarification. Generally 6-8 oz. of Pectinol is required for 100 gallons of juice kept for 12 hours at about 100°F.

Purification of honey

E (IS) 93

We request you to send us some details about the purification of raw honey before packing into bottles. (Guntur).

We have not done any work on this aspect of the problem. Reference to the literature has shown the following method for the clarification of honey:

Raw honey contains suspended organic impurities. For clarifying it, the honey is heated to about 70-80° C, churned or centrifuged, and filtered while still hot through specially packed sterile filter columns. Another method is to strain the raw honey extracted from hives through a sieve or better through a muslin and then allow it to ripen in tanks for about 24 hours, when all the air bubbles contained in it escape. Otherwise they form a scum on the surface. Large honey packing stations use vacuum settling tanks. For any further details regarding the various aspects of honey, you may kindly contact any of the following:

- (1) SHRI R. N. MUTHU,
Hon. General Secretary,
All India Bee Keepers' Association,
Ramgarh P.O., District Nainital, U.P.
- (2) DR. G. B. DEODIKAR,
Hon. Research Director,
Agricultural Research Laboratories,
Home Guards Building,
(Near College of Agriculture), Poona.

(3) SHRI B. G. GUPTA,

Apiarist,
Dept. of Agriculture,
Govt. of Mysore, Seshadri Road,
Bangalore.

Preparation and packaging of curry powders

E (IS) 94

In the manufacture of curry powders, spices like red chillies, coriander, turmeric, etc. can be easily powdered in a pulveriser. But garlic, another important ingredient, cannot be powdered with the above machine. I shall appreciate if you kindly suggest a method of preparing garlic powder. In view of the high cost of tin containers, I intend packing the curry powder in polythene bags and would like to know whether there would be any chemical reaction. Please advise me on the feasibility of this method of packaging. (Alwaye).

We have in this Institute developed a method for the preparation of garlic powder, which is covered by a patent. If you are interested in exploiting this process, you may contact the Secretary, National Research Development Corporation, Mandi House, Lytton Road, New Delhi. We have not done any work on curry powders.

As regards the packaging aspects, polythene bags can be used for packing the curry powder without any fear of chemical reactions. The colour of the product is not affected by polythene. Although curry powder packed in thick (heavy gauge) polythene bags and stored under normal conditions keeps well for fairly long time, the flavour is adversely affected. It would be advisable to pack the curry powders in bulk in big lever-lid tin containers and repack them whenever necessary in polythene bags for retail sale purposes.

Production of citric acid

E (IS) 95

I would very much appreciate if you can kindly send me detailed information on the manufacture of citric acid from lemon or any other

source with a scheme giving the necessary equipment and its cost, minimum quantity of lemon required per day, working capital, etc. to run a small factory. Can you suggest the name of places where such factories are existing? (Nadiad).

We have not done any work on the manufacture of citric acid from lemon juice and as such, regret our inability to furnish you details regarding the scheme for setting up of a plant for the purpose. We are, however, giving below the information collected from the literature. We might mention here that citric acid is nowadays mostly produced all the world over by the mold fermentation of sugar solutions. The National Chemical Laboratory, Poona has worked out a method for the production of citric acid by mold fermentation and you may contact the Director, National Chemical Laboratory, Poona for the details thereof.

Manufacture of citric acid: Citric acid is generally extracted from (1) lemon juice, (2) pineapple waste and (3) by fermentation of sugars with certain molds, particularly *Aspergillus niger*.

1. **Extraction of citric acid from lemon juice:** Lemon juice contains about 6-8 per cent citric acid. The juice is extracted from the pulp and collected in large wooden or steel tanks when it is allowed to undergo spontaneous fermentation for 4-10 days depending upon the temperature. This fermentation destroys and agglomerates the sugar, pectin and fine albuminous matter present in the juice converting into alcohol. Otherwise, these materials obstruct efficient filtration of the juice. The process is not allowed to proceed beyond the point at which the sugars are completely fermented, as yeasts will begin to attack the citric acid. When the spontaneous fermentation has reached the proper stage, a filtering aid, usually diatomaceous earth, is added and the mixture agitated while being heated. It is then filtered through large rack-and-frame presses or

rotary presses. The filtered juice is taken in big vats and the citric acid is precipitated in the hot (60°C) as Ca-citrate by the addition of milk of lime alone or with CaCO_3 as well towards the end till the effervescence ceases. After complete neutralization, the mixture is heated and filtered through suitable plate filters, rack-and-frame presses or rotary presses. The precipitate is washed with hot water and then decomposed with concentrated H_2SO_4 . The resulting CaSO_4 precipitate is separated and the filtrate is concentrated in vacuum or open pans to a density of 20-25° Brix. It is then filtered or decanted from the CaSO_4 that separates during concentration. The concentration is continued to a density of 37-38° Brix from which the citric acid is crystallised out on cooling and agita-

ting. The crystals are later purified to free it from metallic and other impurities.

2. *Extraction of citric acid from pineapple waste:* A second natural source of citric acid is found in the residues and wastes of the pineapple canning industry. The pineapple contains 0.39-1.10 per cent citric acid, averaging about 0.72 per cent. The residues are collected, cut, and pulped in suitable machines and pressed. The pulp is leached with water or a dilute liquor from a previous extraction and concentrated. Citric acid is recovered as the calcium salt as described above.

3. *Preparation of citric acid by sugar fermentation:* Numerous molds are known to produce citric acid from sugar, but the most important ones are the various strains of *Aspergillus niger*. The indus-

trial process consists essentially in inoculating a sterile sugar-containing solution in culture vessels with a suitable organism. At the optimum temperature for growth, the mycelium (mass of interwoven filaments) is formed first, and then citric acid. Fermentation is completed in 5-14 days. The liquor is then drawn off, the mycelium washed and pressed to remove any citric acid present within the cells and the liquor transferred to a suitable tank for recovery by precipitation as the calcium salt in the usual way.

The world's major production of citric acid is by the mold fermentation process.

There is no factory in India producing citric acid and all of it is imported. We feel that the production of citric acid from lemon juice is not going to be economical.

BECKMAN DB ULTRAVIOLET SPECTROPHOTOMETER

Ex: M/s BECKMAN INSTRUMENTS INC. U.S.A.

This is a least expensive but most versatile instrument covering ultraviolet and visible regions for quantitative and qualitative analysis in agricultural, food, clinical, pharmaceutical, plastic laboratories and chemical works and Research institutions. It incorporates a double beam operation and the controls are few. It has a direct readout system reading in absorbance and % transmittance. With the wave length drive accuracy and the new inexpensive potentiometric recorder it forms the moderately priced ratio—Recording uV-visible spectrophotometer. A special flame attachment is available and estimation of more than 30 elements.

Special features:

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For further details approach Sole Agents:

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Notes and News

NEWS BRIEFS

Fat bloom in biscuits: Fat bloom, a long standing problem of biscuit manufacture, often appears haphazardly as a greyish-white discolouration on the surface of a wide range of biscuits, though more often in those of higher fat contents. It seems to be associated with the appearance of solidified fat on the surface of the biscuit and investigations so far have therefore been concentrated on the effects of different types of fats in short-sweet biscuits.

It has been found that there are marked differences between the liability of fats to produce bloom. An important conclusion is that the degree of hardness, as measured by solids index, can be roughly correlated with tendency to bloom. With single fats it might be possible to state a maximum desirable solids index depending on the type of biscuit and manufacturing process, above which there will be the likelihood of bloom. The situation, however, may become more complicated when blends of several fats are used (*Brit. Baking Ind. Res. Assoc. Rep.*, November 1960).

Fruit holding in high-ratio cake batters: The usual type of cake batter made from a formula with a high ratio of sugar and liquor to flour has a thin consistency and is unable to support fruit during baking. The introduction of high-protein high-ratio cake flours enabled cake batters to be produced which would support fruit during baking and yet retain the advantage of the tender crumb associated with a high sugar and liquor content.

A research report has now been published which deals with the factors involved in the sinkage of cherries and sultanas in high ratio cake batters.

It has been found that fruit is most likely to sink when the batter temperature is between 140°F and 160°F, and the effects of chlorination, protein content and particle

size variation of the flour on sinkage have been investigated.

An important finding is that the acid raising agent used in the recipe affects fruit holding capacity and the suitability of various compounds is discussed.

The Report includes careful definitions of all the rheological terms used and a full description of the simple quick batter tester developed for practical use in bakeries to indicate whether a batter will have good fruit holding capacity (*Brit. Baking Ind. Res. Assoc. Rep.*, November 1960).

New rotary granulators: A new range of granulators to deal with sticky or waxy materials which are difficult to handle in comminuting mills has been developed by Apex Construction Ltd. Known as the no. 52, the new type of machine is claimed to produce firmer and stronger granules than those produced by any other method, as well as giving high production throughout. This granulator will also handle plastic materials including those of a waxy nature. The makers say that the 52 granulator has been successfully applied in the food industry for the production of products in a granulated form, including vitamised cocoa products, dog foods, etc. (*Food Manuf.*, August 1960, p. 345).

Investigations on yellow beef fats: Research carried out at the German Federal Meat Research Institute, Kulmbach, has shown that yellow coloration of beef fats is mainly due to carotene carbohydrates, i.e., alpha, beta and gamma-carotene, but mono- as well as poly-hydroxycarotinoids are also present. On an average, about 65 per cent of the total coloration is caused by beta-carotene. Vitamin A content is relatively low (*Food Manuf.*, August 1960, p. 350).

Determination of tin in foods: The sample is ashed with MgO, then fused with KCN and Na₂CO₃, and tin is determined colorimetri-

cally in an extract of the melt with dithiol. The interference of copper which may be present in some products, e.g., tomato puree, can be eliminated by adding KCN to the solution and filtering. Results for samples of canned and bottled beverages and foods are reported (*Food Manuf.*, August 1960, p. 350).

Rapid fish thawing method developed by Torry: The industrial thawing of frozen fish, which normally takes up to 24 hours in air can now be done in about 15 minutes by dielectric heating. It is of great economic importance, especially in view of the steadily increasing large-scale utilisation of frozen fish, and may have wide application in other sections of the food industry.

The method, known as dielectric thawing, depends on the fact that if any material is placed between, but without touching, two metal plates which are charged with an alternating voltage of many thousands of volts at a frequency of about 40 million cycles per second, energy is produced in the material in the form of heat. Under well defined conditions, fish may be uniformly thawed throughout a block of the frozen material, either as whole fish as in the case of herrings or as fillets. It is possible to control conditions far more accurately than in existing methods, for example, so that individual fish in a block may be separated while remaining partially frozen. Fish may be fed into the machine on an endless belt and thawed in 15 minutes.

The potential results of this development, which is the subject of a patent application are such that they could revolutionise certain sections of the fish handling and processing industry in a relatively short space of time (*Food Manuf.*, August 1960, p. 352).

Transport of unfermented fruit juice in textile tanks: The firm of Krupp has developed novel large containers which are very light in weight, but can be employed

for the transport of large loads. A tank of 330 gal. capacity weighs (including the carrier bag) only 31 lb.

The body of the foldable tank consists of a highly tear-resistant plastics web which is coated on both sides with impact-resistant synthetic rubber. The coating is expansible, elastic and air-tight, and resistant to benzene, benzene tetrachloride, sea water, diluted acids or lyes. It also possesses very good resistance to fungi, bacteria and termites. The tanks can be used for transport of water, if necessary and also for wine or milk. Tests were also carried out with fruit juices whose flavour and odour remained unaffected. Technical data concerning these folding tanks are given (*Food Technol. Austr.*, October 1960, p. 557).

Mechanical apple packer: To save time and labour, prevent bruising of fruit and to improve the presentation of export apples, a mechanical apple packer which pack the fruit into cardboard cartons is being tried at the Mt. Barker Co-operative Ltd., W. A.

The company has already exported more than 1,700 bushels of apples packed in papier mâché trays in cardboard cartons.

The main object of the machine is to cut overhead costs so as to compete more effectively with exporters from South Africa and the Argentine.

The machine packs apples twice as fast as by hand (*Food Technol. Austr.*, October 1960, p. 592).

Improvements in foam-mat drying result from perforated plates: A recently devised method, called crater technique, has considerably improved the foam-mat method of drying liquid foods.

In the new method, a layer of foam is spread on a perforated metal tray. A controlled air blast is directed through the tray from below so that the foam in and above the perforations is spread aside but not splattered off the tray. Drying air is then passed through

the perforations until the cratered layer is dry.

Several practical schemes have been suggested that would permit continuous and automatic loading of trays, conveying them through the dryer, removing the dry product and recycling trays to feeder (*Food Engng.*, August 1960, p. 79).

Castor-oil film preserves food: Foods are now being preserved for periods up to four months in a film derived from castor-oil. The method, developed in France by the Societe Organico, uses a straight-chain polyamide, nylon-11, derived from the oil.

Ham is one of the foods for which the new pack is suitable. It is partly cooked and then packed in the nylon film, sealed and the cooking is continued. A wide range of other foods can also be preserved in this way and given prolonged storage life.

The fact that it is virtually impermeable to moisture and gases makes the transparent film particularly attractive for vacuum packing of such diverse foods as fish, coffee and cheeses. For such uses its combination of properties is said to compensate for its relatively high price compared with other plastic materials.

Experiments are now being conducted in laminating the nylon film to a copolymer of vinyl chloride and vinylidene chloride, by which it is hoped to reduce the already insignificant permeability of the film and so to extend storage life to at least six months.

Working temperatures of the film lie in the range -45 to $+100$ deg. C.; sterilization at 130 deg. C. should not be prolonged beyond half an hour. Tests have shown that sterilization does not diminish the film's effectiveness as a bacterial barrier.

At some French ports, fresh white fish is being packed in the film and held at -30°C. to prevent bacterial decomposition until it reaches the customer. Despite exposure to this low temperature,

no brittleness or cracking of the pack has been reported.

As an alternative to glass containers and tins, semi-rigid packs are being developed for meat and products which the supplier might want to sterilize in the pack or fill hot. Such containers are made by vacuum drawing of a film having somewhat greater thickness than the 0.0016 in. film used ordinarily (*Food in Canada*, July 60, p. 7).

Vacuum freeze-drying for meats and vegetables: A process developed by the Defence Research Medical Laboratories is said to result in fresh-tasting foods which will keep for a year without refrigeration. A contract has been let for construction of the first commercial unit, for the Armed Forces, and a number of meat packing firms will be asked to bid on a research contract to operate the unit on their premises. Advantages claimed for the process include a 70 per cent reduction in weight and stability. Raw meats are reconstituted by soaking in water for a few minutes before frying or boiling, and cooked meats need only be mixed with hot water and served immediately. The process involves freezing and drying at the same time, with the water in the food being sublimed directly to the water vapour state without turning liquid (*Canad. Food Ind.*, June 1960, p. 47).

New type apple juice: A new type of apple juice has been developed by scientists at the Geneva Experiment Station, U.S.A. It is made by the addition of ascorbic acid to the apples as they are ground up just before they are pressed. The addition helps in protecting the juice from discoloration and change in flavour due to action of oxygen in the air. The apple juice retains the natural cloudy yellowish juice colour, its body and flavour. Apples can be sprayed with ascorbic acid solution during or immediately after milling but before pressing. The added vitamin C also increases the nutritive value. Commercial application of this method depends not

merely on the fortification technique but also on the use of improved and rapid methods of preparing the juice (Abstracted from *Canad. Food Ind.*, July 1960, p. 28).

Unique vegetable gum for food processing: A unique vegetable gum in dry powder form derived from okra is now made available in semi-commercial quantities in U.S.A. Water dispersions of dehydrated okra are similar to those of other water soluble gums like gum tragacanth, arabic and karaya, which provide bodying and protective action for emulsions. Okra gum has the unique property of forming a 'rope' with pouring qualities similar to natural egg white. The gum is expected to have wide application in the food industry. It is an ideal flavouring and bodying agent in vegetable soups and gravies. Several possible uses for okra gum are given, viz., as an emulsifying agent, in cheese spreads, in dry soup and salad dressing mixes, in confectionery and ice cream fields, as an antioxidant in oils and fats, etc. (Abstracted from *Canad. Food Ind.*, August 1960, p. 34).

Effects of monosodium glutamate on food flavours: Studies made in USDA's Agricultural Service have answered some of the oft-repeated questions on the use of monosodium glutamate. The results have revealed that the amount of glutamate naturally present in foods affects the flavouring value of added glutamate. It enhances the flavour in foods low in natural glutamate while it has little effect on foods having high natural glutamate contents. Natural glutamate content can thus serve as a guide to amounts to be added. Other factors such as levels of thickening agent, fat content and seasonings do not greatly influence the ease of detection of added glutamate. Addition of glutamate to frozen foods does not reduce the development of off-flavour, nor does it mask it in taste tests. Glutamate was retained without loss in several canned foods studied (Abstracted

from *Canad. Food Ind.*, August 1960, p. 56).

INDIAN PATENTS

(A few of the Patent Applications notified as accepted in Part III—Section 2 of the Gazette of India, September 3-24, 1960 are given below.)

67459. Apparatus for continuous fermentation and drying of processed tea leaf: Comprising a fermentation chamber, drying chamber, means for supplying air to the chambers horizontal trays running one above another in the chambers, a pair of endless chains one on each side of the chambers, passing along each tray run over sprockets and trays mounted on and between the chains.—Patented by the Chairman Indian Tea Association.

67734. Improvements relating to the production of lacquered sheets: A rolled aluminium alloy sheet is solution annealed, allowed to age covered with a lacquer and then heated to a temperature of 120°-240°C.—Patented by Aluminium Walzwerke Singen GmbH.

69002. Improvements in or relating to rotary drum mixers: A trough member extending transversely of rotary axis of the drum whilst being open in a direction facing radially outwardly of the axis.—Patented by Wm. Gardner & Sons (Gloucester) Limited.

69078. Improvements in or relating to composite boards of the kind used for making packing boxes and like articles: Jute or like fibrous material sandwiched between a sheet of bitumen paper and a sheet of craft paper by means of a resinous adhesive material.—Patented by C. S. Shaw.

FOREIGN PATENTS

2,917,389. Freeze-drying extends shelf-life of coconut: Discrete chunks of dehydrated coconut that retain the white colour, texture and flavour of the fresh product, and have greater shelf-life than those

prepared by conventional methods is the object of a recent invention.

In the process, fresh coconut is shelled, peeled, washed and chopped into pieces $\frac{1}{4} \times \frac{1}{4} \times \frac{1}{2}$ in. Pieces are slowly frozen (16-24 hr.) to minus 30-40°F., then transferred to trays of dryer through which high-velocity (100-150 ft./min.) hot air (170-180°F.) is blown. Depth of product in trays should not exceed $1\frac{1}{2}$ in.

In 2-3 hr. moisture content is reduced from 50 per cent to less than 1 per cent, bulk density from 30-40 to 15 lb./cu. ft. Chunks are said to retain their white colour for more than 18 months and when reconstituted with water or sugar solution they quickly return to 50 per cent moisture and closely resemble fresh coconut (*Food Engng.*, July 1960, p. 87).

2,930,697. Quick cooking cereal: In a recently patented process for manufacture of quick cooking cereal product, grains are first soaked to cause softening and swelling, then flattened to expose starch, and hydrated to permit further swelling and an increase in moisture content.

This is followed by cooking in minimum of water, hot-air drying to remove surface moisture and set grains in enlarged condition.

Resulting product has a porous, vesicular structure with broken skins adhering. Upon further addition of water grains are said to swell without breaking up (*Food Engng.*, July 1960, p. 90).

2,919,193. Cheese-like product: By combining vegetable fat with sucrose containing oil-free nut extract, homogenizing, cooling, inoculating and forming curd that is drained, pressed and ripened.—Patented by N. S. Berntsson, Goteborg, Sweden (*Food Engng.*, July 1960, p. 128.)

2,923,629. Retarding and accelerating of ripening of vegetables by storing in gas-tight room, subjecting to various gas treatments.—Patented by F. Bonomi, Milan, Italy. (*Food Engng.*, July 1960, p. 128).

2,924,531. *Sterile fruit-milk drinks:* Retention of full fruit flavour, no cooked flavour nor coagulation, are outstanding characteristics of fruit flavoured milk drinks made by a recently patented process.

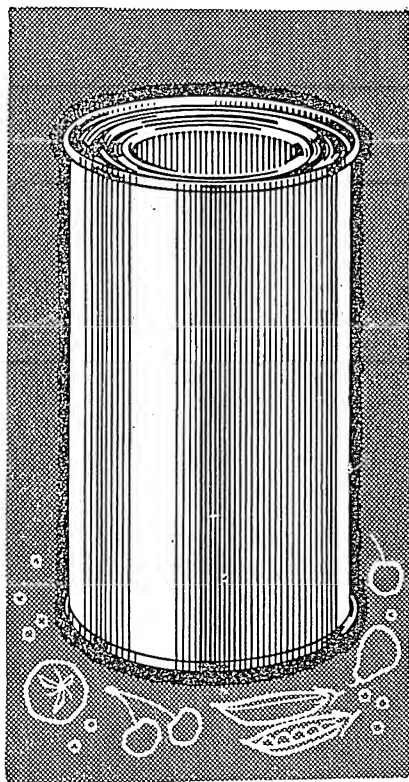
Procedure comprises vacuum deaerating and sterilizing milk product (suggested composition 1 per cent fat, 10 per cent solids-not-fat), then cooling to 70° F. Flavour base (lemon, orange lime, strawberry, cherry, root beer, mint) is separately sterilized, cooled to 80° F. and metered into stream of cooled-sterile

milk. Mixing is obtained as stream flows to aseptic canning unit where drink is filled in sterile cans and sealed (*Food Engng.*, August 1960, p. 80).

C.F.T.R.I. NEWS

Large scale production of MPF: The first pilot unit in the country for the large scale manufacture of Indian Multipurpose Food has been set up at Coimbatore in Madras State. The plant which has a capacity of three tons in eight hours is the result of active collaboration between the Institute, the

Government of Madras and Sri G. R. Govindarajulu, a leading industrialist of Coimbatore. The Government of Madras have decided to purchase the off-take of the plant for incorporation in the midday meal programme of 2½ lakhs of school children in the State. Sri C. Subrahmaniam, Minister for Finance and Education, Government of Madras, who visited the plant on 12th November 1960 expressed the hope that the MPF would be eventually used throughout the State in the school feeding programme.



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Information from Foreign Journals

THE CFTRI has a Technical Translation Service which surveys technical and scientific publications in modern European languages in the fields of Food Science and Technology. The Service offers facilities of translation of scientific articles mainly from German, French, Dutch and Italian periodicals and covers a large number of publications in these languages. The translated material is made available to research workers and industries for their use on terms specified by the Institute. Lists of the translated contents of foreign journals and of the available translated articles are given in this section.

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Food Abstracts

THIS section contains abstracts of papers on Food Science and Technology selected so as to serve the needs of food and allied industries in India and is divided into three parts. Part I comprises abstracts of papers published by the CFTRI, Mysore, reprints of which can be had from the Institute on request. Part II consists of abstracts of papers published in important Indian journals. Part III contains abstracts of important articles from foreign journals.

PART I (Cftri)

Physico-chemical changes in Valencia orange concentrate during commercial scale vacuum concentration, by Pruthi, J. S., *Def. Sci. J.*, 1959, 9 (1), 6.—Changes in refractometric solids ($^{\circ}$ Brix), viscosity, spectral reflectance (colour), pH, acidity, $^{\circ}$ Brix/acid ratio, colour, true ascorbic acid and carotene during commercial scale vacuum concentration of Valencia orange juice in a forced circulation, single-pass falling film evaporator have been reported. With the advancing concentration, there was a gradual increase in $^{\circ}$ Brix, acidity, viscosity, colour, ascorbic acid and carotene, no change in $^{\circ}$ Brix/acid ratio but a slight fall in pH. Upto four-fold concentration of the juice, the increase in viscosity was comparatively slight but after five-fold concentration there was a steep rise in viscosity. There were negligible losses in carotene while the losses in true ascorbic acid were well within 5 per cent during concentration upto 63° Brix. Use of mid-season, healthy, ripe oranges for juice extraction and concentration of the flash-heated juice (195° - 200° F for 10-12 seconds) upto five-fold concentration are suggested.

Studies in packaging and storage of some deep-fat fried vegetables, by Bhatia, B. S., Prabhakar, J. V. and Girdhari Lal, *Indian J. appl. Chem.*, 1960, 23 (2), 73.—Studies in packaging and storage of some deep-fat fried vegetables show the following characteristics: (1) The critical moisture content for deep fat-fried beans, peas and raw banana chips is about 6 per cent corresponding to relative humidity of about 60 per cent. The products lose crispness at a moisture above 6 per cent and a safe upper

limit of 5 per cent moisture may be fixed for them. (2) The products have a very good shelf life. At room temperature they keep well for more than a year. Even at 37° C shelf life is about one year. (3) For prolonged storage life addition of antioxidants to salt used for dusting is beneficial. (4) Colour is stable during storage in field beans and Lima beans and though it slightly deteriorates in peas and broad beans, the products are still considered acceptable. (5) In the case of banana chips, colour during storage is not satisfactory. It may be improved by steeping the slices in sulphide solution before frying. (6) Even cellophane paper packing has been found to be satisfactory showing thereby that packing requirements are simple and cheap. (7) In the absence of antioxidants, refined coconut oil is better than hydrogenated groundnut oil for prolonged storage.

Studies on the non-enzymatic browning of foods: Effect of β -carotene on glucose-glycine model systems, by Kapur, N. S., *et al.*, *Indian J. appl. Chem.*, 1959, 22 (3), 103.—Investigation of the effect of β -carotene on the non-enzymatic browning in glucose-glycine model systems has shown that the presence of β -carotene tends to decrease the formation of brown precursors during storage as indicated by the delayed appearance of the peak at 280-282 m μ and lower value of optical density at the wavelength. Visible absorption spectra and fluorescence values taken during storage indicate that β -carotene is comparatively stable in glycine-carotene system with respect to glucose-carotene system. Fluorescence due to 'Tween' decreases during storage and the β -carotene

inhibits the fluorescence due to 'Tween'.

Preparation of pectin, pectin extract and syrup from jack fruit rind, by Bhatia, B. S., Siddappa, G. S. and Girdhari Lal, *Indian J. agric. Sci.*, 1959, 29 (1), 75.—Method of preparing pectin from different portions of jack rind of ripe jack fruit and rind and core of raw jack fruit has been mentioned. Average yield of crude pectin from rind and core of ripe jack fruit is 1.22 per cent as against 0.47 per cent only in the case of raw jack fruit. Pectin content is maximum in the inner fluffy portion of the rind of ripe jack fruit. Jack pectin extract containing 20-25 per cent soluble solids can be conveniently prepared from jack rind. Even 5 g. of this extract is capable of setting 65 g. of sugar if the pH is properly controlled by adding enough citric acid. Method of preparing crude syrup from jack rind is described. Its analysis has been reported. Because of its high ash content, the syrup is not considered suitable for edible purposes. It may, however, be used for tobacco curing.

Studies on milk substitutes of vegetable origin. Part II. The effect of fortification with DL-methionine on the nutritive value of spray-dried powder obtained from a blend of soya-bean and groundnut milks, by Shurpalekar, S. R., *et al.*, *Ann. Biochem. exptl. Med.*, 1960, 20 (6), 146.—The nutritive values of soya-bean milk powder, groundnut milk powder and modified cow's milk powder and their blends with and without methionine supplement have been studied in experiments on albino rats. Milks reconstituted from soyabean milk powder, ground

nut powder and a blend of these two promoted fairly good growth (12.3-13.5 g. per week) as compared to the reconstituted modified cow's milk having the same protein content (17.1 g.). Milk reconstituted from a mixture of 4 parts of vegetable milk powder and 1 part of modified cow's milk powder promoted significantly higher growth (16.1 g.) than vegetable milk alone. Fortification of vegetable milk powder with DL-methionine caused a marked improvement in its growth-promoting value (16.6 g. per week). No significant differences were observed in the mean haemoglobin and R.B.C. contents

of the blood of groups of rats fed on milks reconstituted from soyabean, groundnut, and modified cow's milk powders and their blends with and without methionine supplements. There were no significant differences in the mean moisture and fat contents of the livers of the different groups of rats fed on the different milks. The mean protein content of the livers of rats fed on groundnut milk and vegetable milk blend was significantly lower than that of the animals fed on cow's milk or a blend of vegetable milk and modified cow's milk. There was no significant difference in the mean moisture and fat contents of

the carcass of rats fed on different milks. The protein content of the carcass of rats fed on the vegetable milk was slightly lower ($P=0.05$) than that of animals fed on modified cow's milk. The protein efficiency ratios of the proteins (at 10 per cent level) of modified cow's milk powder, a mixture of 4 parts of vegetable milk powder and 1 part of modified cow's milk powder and vegetable milk powder decreased in that order. Fortification of vegetable milk powder with DL-methionine brought about a significant increase in the protein efficiency ratio of the proteins.

PART II (Indian)

ANALYTICAL

Agar electrophoresis: Comparison with other methods and its application in the analysis of serum proteins in pregnancy and lactation, by Deb. A. K. and Giri, K. V., *Ann. Biochem. exptl. Med.*, 1960, 20 (7), 171.—The results obtained by agar electrophoretic analysis of serum proteins during pregnancy and puerperium of Indian women are described. The differences between the results obtained by agar electrophoretic technique and those by paper electrophoresis and salt fractionation method and the reasons for these differences are discussed.

The comparative study shows that agar electrophoretic technique is more elegant, requires less space, material, time and possesses advantage over other methods in providing a better resolution of the different components and as such the results are more accurate. This technique provides useful indication as to the nutritional status and clinical course during pregnancy and thereafter.

BIOCHEMISTRY AND NUTRITION

Phosphopeptides from bovine casein, by Ramachandran, B. V. and Sivaraman, C., *J. sci. industr. Res.*, 1960, 19 C (10), 244.—The

digestion of cow's milk casein by crystalline pepsin and then by crystalline trypsin and subsequent fractionation by paper electrophoresis has been found to result in the separation of at least seven different phosphorus-containing peptides, two of which have been obtained in a relatively pure form. The amino acid composition of a few of these peptides has been determined. Significant differences have been observed in the composition of phosphopeptides isolated from α -casein and β -casein.

Stabilization of vitamins in pharmaceutical preparations: Part II—Influence of metallic ions on the stability of vitamin C in oral formulations

, by Uprety, M. C., Sen, F. and Mohan Rao, V. K., *J. sci. industr. Res.*, 1960, 19C (10), 249.—The stability of vitamin C in glycerol, sorbitol and cane sugar syrup bases containing varying amounts of water and 0.01 per cent of calcium, copper, iron and magnesium salts has been investigated, maintaining the pH of the formulations at 4 and storing them for 3 months at 37°C. Glycerol has been found to afford maximum protection to the vitamin in presence of different metals. Maximum deterioration of the vitamin has been observed in formulations containing copper and least in those

containing iron. Dilution of the bases with water results in greater deterioration of the vitamin.

Studies in palm molasses, by Kamat, P. G. and Kamala Sohoni, *J. sci. industr. Res.*, 1960, 19 C (10), 257.—Sucrose has been found to be the principal carbohydrate present in palm molasses, other carbohydrates detected being glucose and fructose. Of the B-group vitamins thiamine, riboflavin and nicotinic acid, present in palm molasses, riboflavin and nicotinic acid are present in larger amounts. Vitamin C and other indophenol reducing substances have also been detected.

FERMENTATION

Use of ammonium fluoride as a protective antiseptic in alcoholic fermentation of molasses, by Krishnamurthi, B. G., *J. sci. industr. Res.*, 1960, 19 C (10), 255.—The preservative action of ammonium fluoride in alcoholic fermentation of molasses wash has been compared with that of sulphuric acid and it has been found that ammonium fluoride is neither as effective nor as economical as sulphuric acid.

MICROBIOLOGY

Metabolic changes during citric acid fermentation by As-

pergillus niger, by Joshi, A.P. and Ramakrishnan, C. V., *Ann. Biochem. exptl. Med.*, 1960, 20 (7), 177.—The mycelial mat of *A. niger* at progressive stages of fermentation was studied for its enzyme make-up. It was observed that the accumulation of citric acid in the medium was accompanied by a rise in the activity of pyruvic oxidase, oxaloacetic carboxylase and condensing enzyme and a disappearance to zero of the activities of oxaloacetic hydrolase, acetyl CoA deacylase and aconitase. These changes are highly favourable for the formation and accumulation of citric acid.

OILS AND FATS

Chemical examination of the seeds of *Clitoria ternatia* Linn, by Sinha, A., *J. & Proc. Inst. Chem.*, 1960, 32 (4), 171.—The roots, leaves, flowers and seeds of the plant are reported to possess valuable medicinal properties. The seeds have been examined in the present study for the contents and nature of ash, oil, and reducing sugars. The seeds have an ash content of 2.45 per cent of which 43.5 per cent is water-soluble and rest acid-soluble. The mineral composition of the ash is given. The seeds are found to contain 18.78 per cent of a fixed oil obtainable by extracting with

petroleum ether. The fatty acid composition of the oil is as follows: oleic, 51.6; linoleic, 15.8; myristic, 1.8, palmitic, 8.8; stearic, 3.5 and arachidic, 1.0 per cent respectively. The unsaponifiable matter has been identified as Δ -sitosterol. It is found that the seeds contain 2.1 per cent reducing sugars, which have been chromatographically identified as arabinose, xylose and rhamnose.

SPICES

Capsaicin contents of chilli varieties, by Ananthasamy, T. S., Kamat, V. N. and Pandya, H. G., *Curr. Sci.*, 1960, 29 (7), 271.—Chillies, green, red and sun-dried are widely used in the Indian dietary. The present note describes the quantitative data on capsaicin, the pungent principle. Capsaicin is extracted from the samples with acetone and then estimated colorimetrically. The amounts of the pungent component present in four varieties of green chillies are as follows: *Phugi* (big), 7.5; *Dharwar* (big), 23.7; *Lavangi* (small), 20.4 and *local* (small), 17.6 mg. per cent on fresh weight basis. The changes occurring during ripening and sun-drying have been studied with the local variety which contains 57.0 and 80.0 mg. per cent respectively at the ripe and sun-

dried stage. The capsaicin content is found to decrease during ripening and sun-drying of chillies when the values are expressed on moisture free basis. The small *lavangi* variety of green chillies, well known for the pungency, contains the maximum amount of capsaicin while the big *phugi* variety used as a vegetable contains the least.

K.L.R.

GENERAL

Chemical examination of the mucilage from the leaves of *Tinospora crispa*, by Sinha, A., *Indian J. appl. Chem.*, 1960, 23 (2), 87.—The mucilage obtained as a white powder from the leaves of *Tinospora crispa* (Fam. *Menispermaceae*) has been found to be non-reducing in character, optically active ($[\alpha]_D^{25} = 20^\circ$) and possessing no acetyl or methoxyl group. It shows positive tests for galactan, pentosan and methylpentosan. The hydrolysis of the mucilage with 10 per cent H_2SO_4 shows the presence of arabinose and galactose. The methylated mucilage on hydrolysis affords two sugars, one of which has been identified as tetra-O-methyl-D-galactose. The quantity of the other sugar was extremely small and could not be examined. The chemical and the physical characteristics of the mucilage have been studied with a view to ascertaining the structure of the mucilage.

PART III (Foreign)

ANALYTICAL

The determination of soluble solids in citrus juices. 1. The effect of non-sucrose components on refractometer values, by Scott, W. C., Morgan, D. A. and Veldhuis, M. K., *Food Technol.*, 1960, 14 (9), 423.—Effects of non-sucrose components of citrus juices on their refractometer sugar scale values were studied. The only two components whose refractive indices in solution have been compared with sucrose and reported in the literature are citric acid and reducing sugars. Both have lower indices of refraction than sucrose and,

therefore, require positive corrections for the refractometer sugar scale to indicate true soluble solids. Other components studied had higher indices of refraction than sucrose. Negative corrections required for both amino acids and pulp are greater than positive corrections required for citric acid at equivalent concentrations. Negative corrections required for citrate salts, flavonoids and pectin are considerably less; those for ascorbic acid and peel oil are practically negligible.

Detection of some deoxy sugars and aldehydes using thio-

barbituric acid, by Saslaw, L. D. and Waravdekar, V. S., *Arch. Biochem. Biophys.*, 1960, 90 (2), 245.—Some aldehydes may be visualized on filter paper with the use of a thiobarbituric acid reagent. This reagent yields intensely coloured derivatives with conjugated aldehydes. Enolic compounds may also react to yield less intensely coloured derivatives. Some sugars may be converted to the reactive aldehydes by oxidation with periodic acid. Extension of the procedure for the chromatographic visualization of some deoxyribosyl compounds is also described.

Carbohydrates of *Ecklonia radiata*, by Stewart, C. M. and Higgins, H. G., *Nature*, 1960, 187, 511.—A preliminary study has been made of the carbohydrates present in the brown algae, *Ecklonia radiata*. Fresh, whole seaweed was milled through drecker plates in a Baner defiltrator and the carbohydrates extracted with 1 per cent HCl. Two fractions of polysaccharides were precipitated at 74.1 and 85 per cent ethanol concentration, the yield being about 6 per cent. Fraction I was made up of laminarin and fucoidin, while fraction II contained only laminarin. Laminarin and fucoidin have been separated by fractional precipitation of I with ethanol and on anion-exchange resin column. Mannitol and alginic acid have also been isolated from the algae. The average contents of the four carbohydrates, viz., mannitol, alginic acid, laminarin and fucoidin present in the laminae and midrib portion of the brown algae have been given.

K.L.R.

BIOCHEMISTRY AND NUTRITION

The preparation of a semi-synthetic diet low in copper for copper-deficiency studies with the rat, by Mills, C. F. and Murray G., *J. Sci. Fd. Agric.*, 1960, 11 (9), 547.—Procedures for the production of a semi-synthetic, copper-deficient rat diet are described. The final product contains between 0.3 and 0.4 μg . of Cu per g. When supplemented with copper, the diet promotes rapid growth and good reproductive performance. With slight modification the diet would provide a suitable basal ration for studies of deficiencies of iron, zinc and manganese.

Pyrophosphate metabolism in liver mitochondria, by Rafter, G. W., *J. biol. Chem.*, 1960, 235 (8), 2475.—Liver mitochondria were shown to catalyze the formation of glucose-6-phosphate from glucose and pyrophosphate. The reaction was inhibited by *p*-mercuribenzoate fluoride and molybdate. At the pH

optimum of the reaction, 5, 2, incubation of the mitochondria in the absence of substrate rapidly destroyed their glucose-6-phosphate forming ability. The inactivation was prevented by reagents which inhibited the hydrolysis of pyrophosphate.

Simultaneously with the formation of glucose-6-phosphate from pyrophosphate and glucose, inorganic phosphate was formed from pyrophosphate by the action of an inorganic pyrophosphatase. The characteristics of the two reactions closely resembled one another. The formation of both products from an intermediate of pyrophosphate metabolism was discussed.

EGGS

The comparative biochemistry of avian egg white proteins, by Feeney, R. E., *et al.*, *J. biol. Chem.*, 1960, 235 (8), 2307.—The egg white of 25 different avian species or varieties were examined by specific biochemical and chemical analyses, by chromatographic separations of the constituent proteins and by examinations of the properties of several of the purified proteins. The constituents studied included sulfhydryl groups, sialic acid, lysozyme, apoprotein flavoprotein, conalbumin, and ovalbumin.

Large differences were found in the amounts of various of these substances in the white from the different birds. In the cases of lysozyme and sialic acid, differences as great as 30-fold were found. Differences in the properties of several of the purified proteins were also found.

The significances and values of the results from the standpoints of comparative and genetic biochemistry were discussed.

ENZYMES

Isolation and characterization of an enzymically active fragment of papain, by Hill, R. L. and Smith, E. L., *J. biol. Chem.*, 1960, 235 (8), 2332.—Mercuripapain can be degraded by large

amounts of leucine aminopeptidase to an enzymically active fragment. Chromatographic procedures were developed which permit isolation of the fragment in homogeneous form as judged by its chromatographic behaviour, amino acid composition and electrophoretic behaviour over a wide pH range.

Amino acid analysis showed that the isolated active fragment contains an average of 76 residues in contrast to intact papain which contains 185 residues per mole. The molecular weight calculated from these analyses is 8,375, a value which is in accord with estimates obtained from ultracentrifugal analysis and measurement of specific activity.

The α -amino end group of the fragment was shown by the phenylisothiocyanate method to differ from the α -amino end group of intact papain.

On the basis of paper electrophoretic analysis, the fragment has an isoelectric point near that of intact papain and nearly the same mobility above the isoelectric region, but different mobilities in the pH range acidic to the isoelectric region.

Both intact papain and the fragment have a maximal absorption at 2784 Å at pH 5, whereas spectral analysis at alkaline pH showed distinctly different absorption curves. Calculation from the absorption spectrum indicates that the fragment contains two tryptophan residues per mole. The active fragment is identical with intact enzyme in substrate specificity as judged with four synthetic substrates.

Both intact papain and active fragment possess a similar sensitivity to denaturation by heat, urea, and acid. These results indicate the requirement of an organized three-dimensional structure in the active fragment.

FISH

Changes in the actin of cod flesh during storage at -14°C ., by Connell, J. J., *J. Sci. Fd. Agric.*, 1960, 11 (9), 515.—Actin has been

prepared from fresh cod flesh and from cod flesh which has been stored at -14°C . for up to 127 weeks. The properties of these actin preparations have been compared with respect to ability to polymerise and to combine with cod myosin. It is concluded that up to the time (30 weeks) when the actomyosin portion of the salt-soluble protein of the flesh becomes completely insoluble, there is only a very small change in the properties of the actin.

FRUIT AND VEGETABLE PRODUCTS

Effect of sodium chloride, citric acid and sucrose on pH and palatability of canned tomatoes, by Leonard, S., Luh, B. S. and Pangborn, R. M., *Food Technol.*, 1960, 14 (9), 433.—To selected lots of California tomatoes, acidified with citric acid to lower the pH and to facilitate heat sterilization, varying amounts of sodium chloride and sucrose were added. Tomatoes were of 5 varieties. Three months after canning, the tomatoes were analysed for pH, acidity, soluble solids, drained weight and flavour acceptability. Addition of citric acid effectively lowered pH but impaired palatability. The proper combination of citric acid, sucrose and sodium chloride improved flavour quality over untreated controls within each variety. Agtron E colour readings decreased from 66 in under-ripe to 42 in canning-ripe and to 35 in soft-ripe tomatoes. Average pH values increased from 4.33 in under-ripe to 4.48 in canning-ripe and to 4.64 in soft-ripe fruit. Changes in pH during storage of the canned product for 3 months at room temperature are discussed.

The relationship of apple maturity to apple sauce quality, by LaBelle, R. L., *et al.*, *Food Technol.*, 1960, 14 (9), 463.—Maturity indices of R. I. Greenings and Baldwin apples (1957 and 1958 harvests) were evaluated. Their relationship to the quality of sauce processed from these apples both with and without

storage ripening was also investigated. An apple sauce pilot plant of 300 lb. per hour capacity was used to process sauce from this fruit under precisely controlled conditions, the equipment closely simulating commercial processing. Pressure test was discarded as a prime index of maturity at harvest in favour of soluble solids-acid ratio in the fresh fruit. The rate of change of pressure test prior to and at harvest was too low to provide reliable differences. Conversely, soluble solids-acid ratio changed rapidly in this sauce period and had a direct bearing on product quality. In addition, the ratio was closely correlated with heat unit accumulation over the two seasons studied. Sauce colour, flavour and grain improved as harvest was delayed to allow the fruit to tree-ripen. This was particularly noticeable if apples were processed into sauce directly after harvest. However, even when fruit was ripened to a common extent, as measured by pressure test or accumulated heat units, sauce from late-harvest apples was still noticeably better. Pressure test and calendar date of harvest were shown to be inferior indices of maturity, but heat unit accumulation and days after full bloom were observed to be about equally effective. The best prediction of apple maturity in 1958 based on results obtained in 1957 would have involved a compromise between the latter two indices.

Optical density of tomato serum from concentrates as a measure of heat induced change in product corrosivity, by Hernandez, H. H. and Feaster, J. F., *Food Technol.*, 1960, 14 (9), 468.—The optical density of serum from tomato products was found to be a useful measure of heat damage during production and storage. Raising storage temperature or increasing solids in the product accelerates darkening of the serum. Service life of the canned product decreases as optical density of the serum, per cent solids of the tomato product or storage temperature is

increased. The desirability of protecting high solids tomato paste from heat damage during production and storage was demonstrated. The method measures light transmission of tomato products and reports results in terms of a colour index independent of the measuring equipment.

FUNGICIDES

Germicidal effect of orange peel oil and D-limonene in water and orange juice. I. Fungicidal properties against yeast, by Murdock, D. I. and Allen, W. E., *Food Technol.*, 1960, 14 (9), 441.—Fungicidal effect of orange peel oil and D-limonene (stripper oil) was determined against *Zygosaccharomyces major* in water and in single strength orange juice at 25°C . Both oils exhibited lethal properties in water (pH 7.0) in concentrations as low as 0.02 per cent; in orange juice 0.1 per cent was required. D-limonene was more effective than orange peel oil in both water and orange juice. Fungicidal properties of these oils in orange juice adjusted to various pH levels were determined. Orange peel oil and D-limonene were more effective at pH 6.0 and 7.0 than they were at pH 3.0 and 4.0. Orange juice adjusted to pH 7.0 with NaOH and containing 0.1 per cent D-limonene was sterile 3 hours after being inoculated with 1,000,000 yeast cells per ml. In juice adjusted to pH 3.0 with citric acid, there were 100,000 viable cells per ml. remaining at the end of a like period. Results indicate that the preservative properties of sodium benzoate can be greatly enhanced by adding orange peel oil and D-limonene in concentrations as low as 0.02 per cent. It appears that these oils are synergistic to sodium benzoate.

MEAT

Proteolysis in the storage of beef, by Locker, R. H., *J. Sci. Fd. Agric.*, 1960, 11 (9), 520.—The method of N-terminal analysis has been applied to the protein fractions

of beef to detect proteolyses on storage at low or high temperature. Parallel studies have been made on the histology, non-protein nitrogen and free amino acids and on the extractability and electrophoresis of the structural proteins. While definite small increases in free amino acids occur, increases in N-terminal groups were negligible. Other results give no evidence of proteolysis. It is concluded that proteolysis is not a significant factor in the tenderising of beef by ageing.

OILS AND FATS

Semimicro determination of total fatty acids and unsaponifiable matter, by Benedict, J. H., *J. Amer. Oil Chem. Soc.*, 1960, 37 (9), 415.—A semimicro method for determining both total fatty acids and unsaponifiable matter in fats, fatty acids and soap is represented. The procedure involves saponification and recovery of the total fatty acids (which includes the unsaponifiables), removal of the fatty acids with anion exchange resins and determination of the unsaponifiable matter by weight.

The total fatty acid method was evaluated on seven samples and showed a standard deviation from the mean of 0.21 per cent. The unsaponifiable matter determination gives good reproducibility with a standard deviation from the mean of 0.06 per cent. Since this ion exchange is a direct determination of the non-ionic components, the results obtained from it should be more accurate and more nearly the true values than the macro extraction method which is empirical.

Search for new industrial oils: IV., by Earle, F. R., *et al.*, *J. Amer. Oil Chem. Soc.*, 1960, 37 (9), 440.—This paper is the fourth in the series of articles on the chemical screening of new sources of oils. Analysis of 160 species representing 52 plant families in 23 orders with respect to oil content, protein content, iodine value, saponification value, refractive index, fatty acid content of the oil and the nature of

absorption in the infra-red region, has been reported. The significance of the results is discussed. Further work in greater detail on the oil and meal of some of the promising species is indicated to ascertain their crop potential and to assess their practical value for providing new oilseeds.

K.L.R.

Effect of autoxidation prior to deodorization on oxidative and flavour stability of soyabean oil, by Evans, C. D., *et al.*, *J. Amer. Oil Chem. Soc.*, 1960, 37 (9), 452.—

Oxidation prior to deodorization was shown to be detrimental to the flavour and oxidative stability of soyabean oil. The increase in the non-volatile carbonyl content of freshly deodorized oils was proportional to the peroxide value of oils before deodorization. Rate of loss of flavour and oxidative stability of the oil were related to the extent of carbonyl development. All oils, whether or not they had been submitted to any known oxidation, contain some non-volatile carbonyls. The loss in stability was not due to a loss of the antioxidant tocopherol.

Oxidised soyabean oil methyl esters were shown to develop non-volatile carbonyl components upon heating at deodorization temperatures. The addition of isolated methyl ester peroxide decomposition products to deodorized soyabean oils reduced its flavour and oxidative stability in proportion to the amount added. The results obtained were parallel and similar to those obtained by oxidising soyabean oil prior to deodorization.

The flavour deterioration and undesirable flavours were typical of ageing soyabean oil whether or not the oils were oxidised before deodorization or whether an equivalent amount of non-volatile thermal decomposition products was added to the oil. These oxidatively derived, non-volatile carbonyl materials are believed to enter into the sequence of reactions that contribute to flavour instability and quality deterioration of soyabean oil. The structure of these materials

is not known. This work indicates the importance of minimising auto-oxidation in soyabean oil, particularly before deodorization to ensure good oxidative and flavour stability.

Extraction of soyabean and cottonseed oils by four solvents, by Arnold, L. K. and Basu Roy Choudhury, R., *J. Amer. Oil Chem. Soc.*, 1960, 37 (9), 458.—Various

solvents are used commercially for the extraction of vegetable oils. Benzene, alcohol and petroleum fractions, particularly hexane fraction, are most commonly used. The commercial hexane contains, besides N-hexane (60-88 per cent), other constituents such as methyl cyclopentane, methyl pentanes and benzene. The present study is aimed at finding out the effect of those non-hexane constituents, on the solubility and quality of vegetable oils. Soyabean and cottonseed have been extracted at 135-140°F with four solvents, *viz.*, 'commercial' hexane, 'high purity' hexane, 'pure' hexane and benzene. The rate of extraction of oil at regular intervals of 10 minutes has been determined in the case of the four solvents. The quality of the resulting oils with respect to free fatty acid content, neutral oil content and colour index has been reported. The results indicate that in the case of soyabeans the extraction by pure hexane was slower than by the other two hexanes. The extraction efficiency of commercial hexanes is definitely more than even benzene. The rate of extraction of cotton seed was, however, practically the same for all the four solvents. Pure hexane extracted the best quality of soyabean oil on the basis of FFA and colour. In the case of cottonseed, the best coloured oil was produced by high purity hexane. Not much difference is observed regarding the performance of the two commercial hexanes for soyabean oil extraction.

K.L.R.

PROCESSING

Studies on the application of infra-red in food processing,

by Asselbergs, E. A., Mohr, W. P. and Kemp, J. G., *Food Technol.*, 1960, 14 (9), 449.—Three types of high-energy, infra-red radiators,—quartz lamps, quartz tubes, and calrods—were evaluated for their effectiveness in blanching apple tissue. Data are presented which show how the depth of heat penetration was influenced by wavelength characteristics, voltage input and energy output of the radiator. Infra-red radiation was used successfully for blanching celery, apples, and peas prior to freezing and in the preparation of french fried potatoes. General quality of infra-red blanched samples was better than that of the samples blanched by conventional steam or boiling water methods. Accompanying weight glasses of upto 35 per cent by weight would result in reduced freezing, storing and handling costs in the case of products intended for later remanufacture. Infra-red was substituted for the parboiling treatment of beef as preliminary heat treatment in preparing beef stew. The colour, texture and flavour of the infra-red-braised, canned meat

was considered superior to that of parboiled meat.

SPICES

Use of calcium hydroxide for firming canned green and red sweet bell pepper, by Hover, M. W., *Food Technol.*, 1960, 14 (9), 437.—The effect of calcium hydroxide and other calcium compounds on the firmness of canned pepper was determined. Among the compounds evaluated were calcium hydroxide, calcium chloride and calcium sulphate. Effects of various methods of treating, duration of treatments and calcium concentrations on the firmness of canned pepper were evaluated. Influence of storage on the firmness of canned pepper was determined. Calcium hydroxide was very effective as a firming agent for canned pepper when applied to fresh pepper prior to heat processing and was the most effective firming agent evaluated. Good results were obtained by all three of the methods used to apply the lime treatments. Best results were obtained in cubed pepper

when the lime was applied at the rate of 0.2-0.4 per cent by weight for approximately 30 minutes followed by a thorough rinse to remove the lime residue prior to blanching and heat processing. When pepper halves were treated, it was necessary to extend the treatment time to 2.5 hours or longer for optimum results. Green pepper responded better to firming treatments than red pepper.

TEA

Mineral composition of clonal tea leaf from North-East India, by Gokhale, N. G. and Bhattacharya, N. G., *J. Sci. Fd. Agric.*, 1960, 11 (9), 526.—Data are presented for the inorganic chemical constituents of tea leaf collected from four different clones grown in Assam. Samples were collected on three different dates during the period July—September 1956. Analyses were made separately of bud, first leaf, etc. The data presented show that chemical composition of tea leaf varies not only with physiological age and date of sampling but also with the clones.

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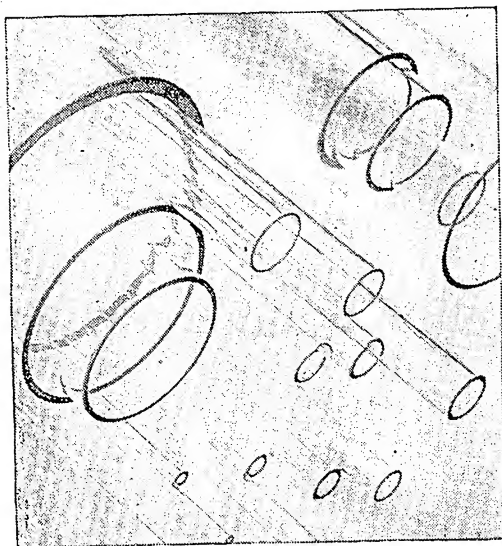


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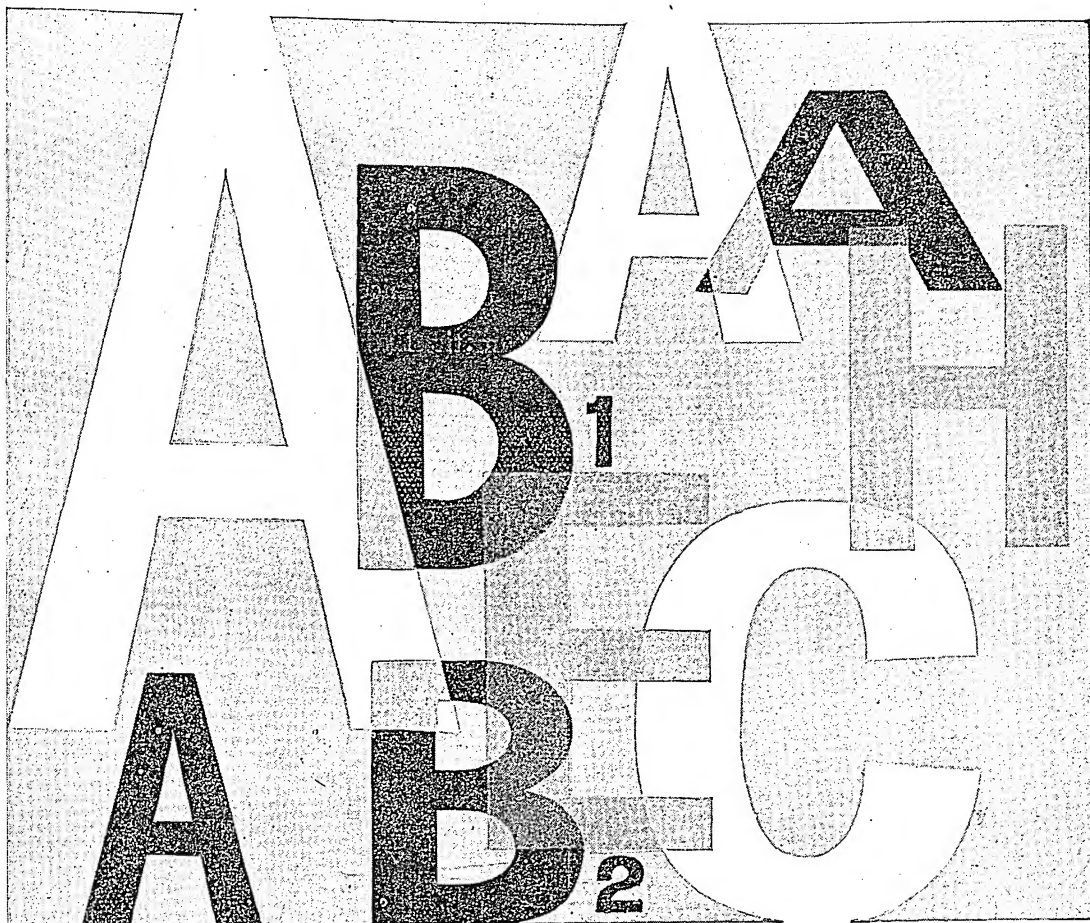
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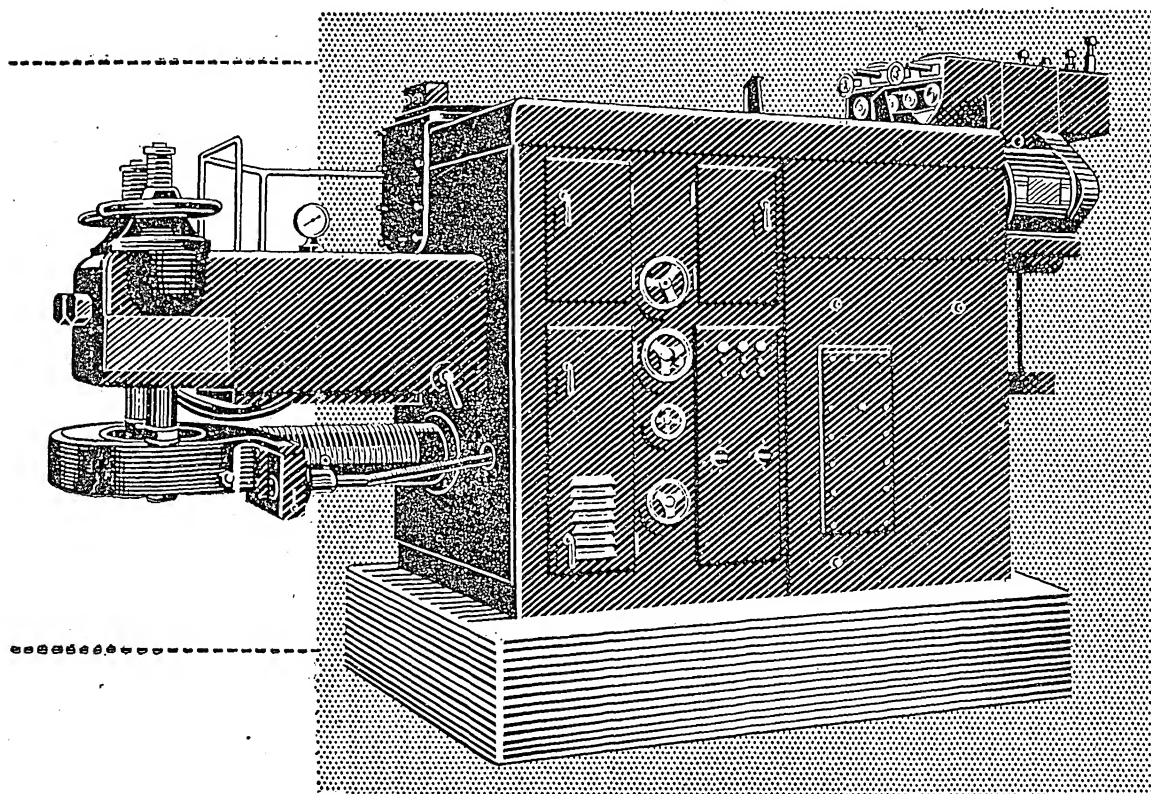
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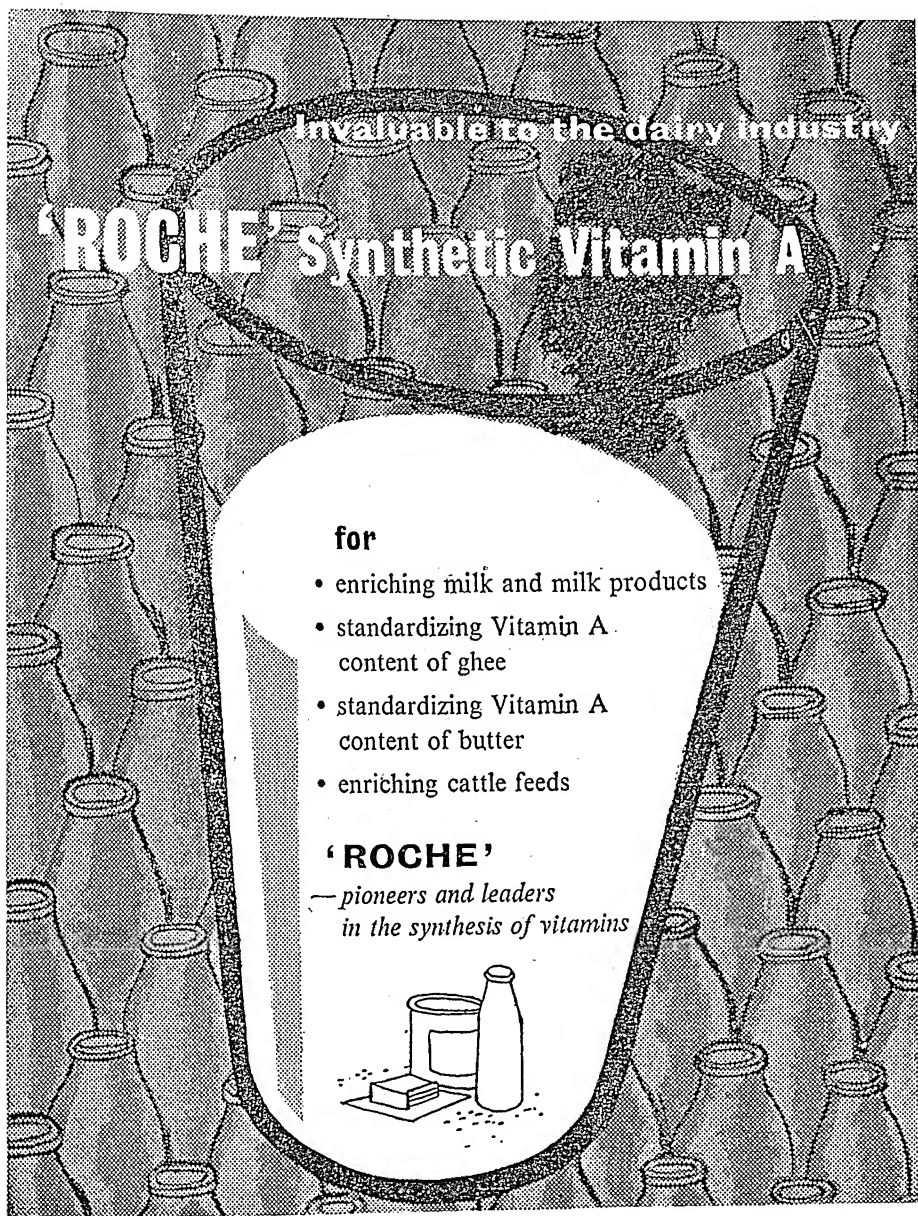


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